MACHINE DESIGN

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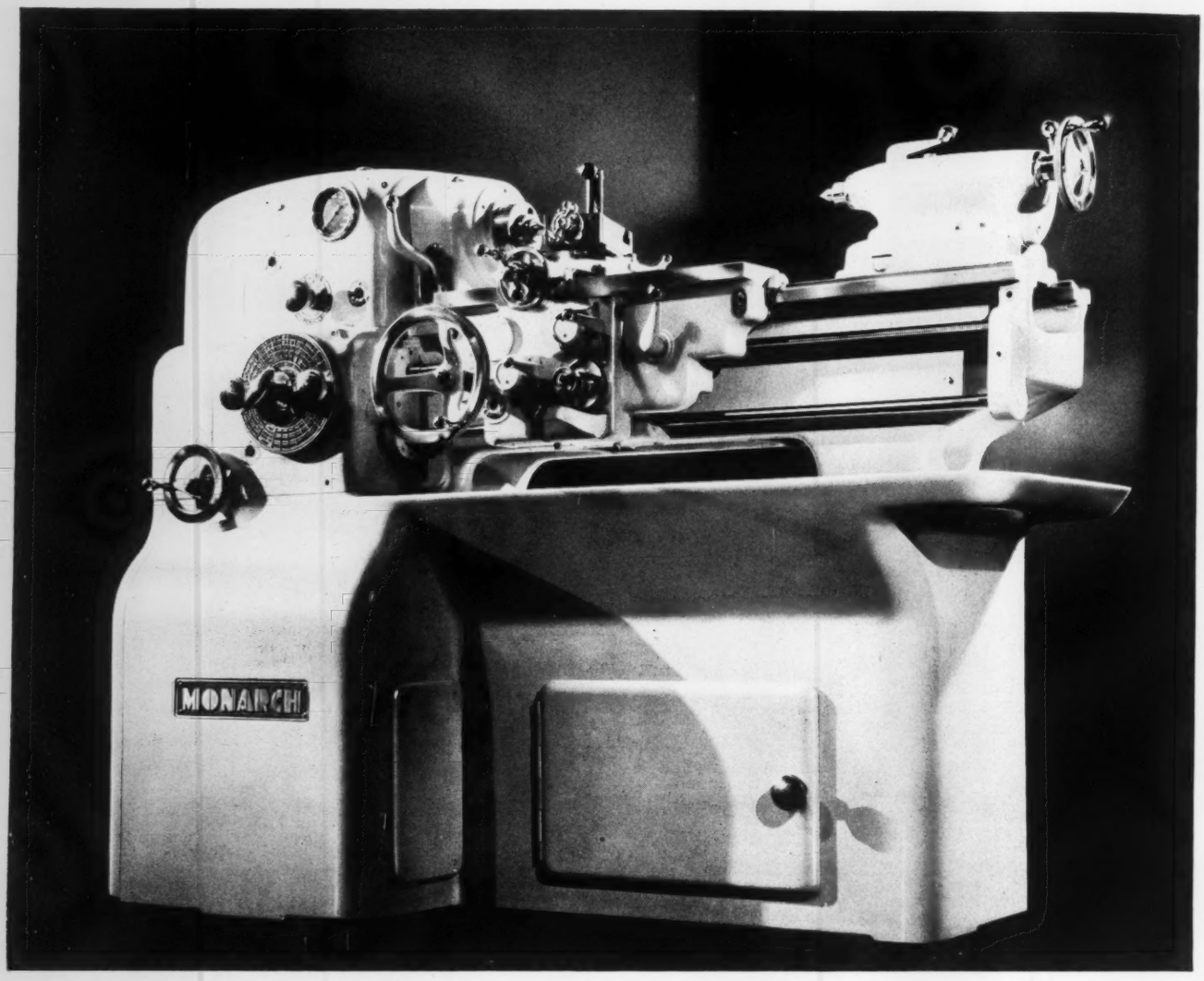
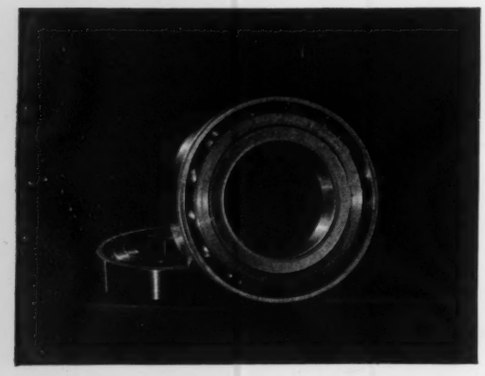


MODERN PRECISION IS *Permanent* ACCURACY



• Monarch designed from the ground up to assure fine bench lathe accuracy in this 10″ x 20″ tool room lathe. But more than this, they designed to make this accuracy a *permanent* feature — one that would endure through years of service. This meant the use of bearings in which wear is practically non-existent — for wear shortens life — destroys accuracy.

The use of New Departure forged steel ball bearings throughout — fine precision bearings, sealed and shielded bearings to the number of 49, as different positions required, reflects the most modern practice in machine tool construction; practice that is greatly concerned, not just with precision, but with the accuracy that *endures*.

New Departure, Division General Motors Sales Corporation, Bristol, Conn. Other offices in Detroit, Chicago, San Francisco.

2783

NEW DEPARTURE

THE FORGED STEEL BEARING

Itemized Index

CLASSIFIED FOR CONVENIENCE WHEN STUDYING SPECIFIC DESIGN PROBLEMS

KEY: EDIT., EDITORIAL PAGES; ADV., ADVERTISING PAGES; R, RIGHT-HAND COLUMN; L, LEFT-HAND COLUMN

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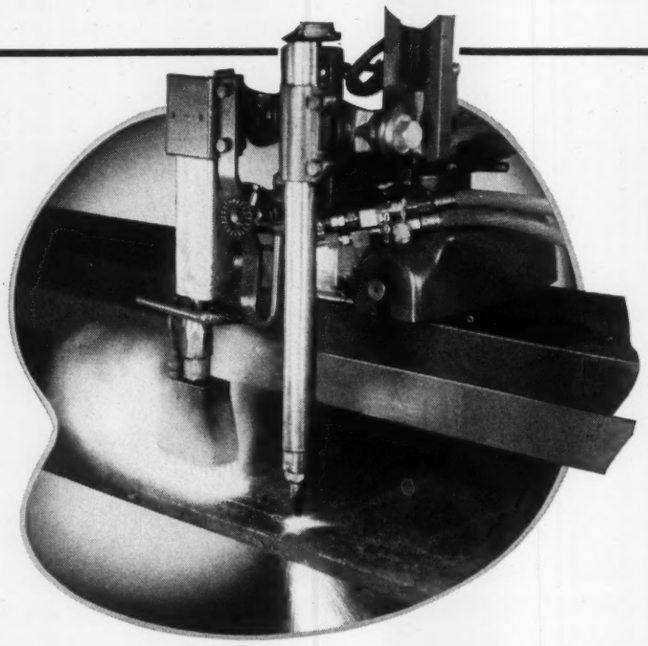
Measured in Terms of Profitable Results..

MEASURED in terms of profitable results, knowing "when, where, and how" to apply industrial processes is what often counts most. Skill in application usually means more on the balance sheet of business than the price of materials used.

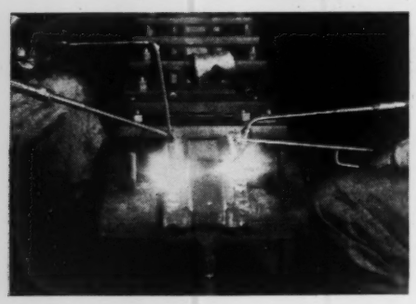
For this reason, Linde goes far beyond assuring the excellence of its products. Linde research works constantly toward the development of new ways to help Linde customers save time and money. Linde's field organization is geared to help customers adapt new or existing processes to their own needs—with an alert eye on control of costs. All Linde men know that, "by helping its customers, Linde helps itself."

Your Linde representative is always ready to tell you more about how Linde methods can benefit your own business. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, Offices in principal cities.

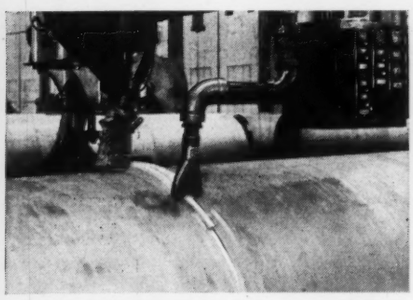


FLAME-SOFTENING—The great bulk of commercially used steel can be flame-cut with no detrimental effect to the cut edge. Certain high-carbon and alloy steels, however, tend when cut cold, to harden along the cut edge. Flame-softening—following the cut—eliminates this problem simply and economically—thereby facilitating subsequent operations such as bending, forming, or machining. Linde men can show you how.

THERE IS MORE TO Linde THAN "EVERYTHING FOR WELDING AND CUTTING"



HARD-SURFACING — The oxy-acetylene flame and Haynes Stellite hard-facing rod—a red-hard, wear-resistant alloy of cobalt, chromium, and tungsten—can economically hard-face wearing parts to make them last longer.



UNIONMELT WELDING — A fully-automatic, electric welding process. It makes high-quality welds in one pass—in any commercially used thickness of steel—as much as 20 times faster than by other methods.

FLAME-HARDENING — The same oxy-acetylene flame shown above *softening* metal, can be used to *harden* the surface of metal parts—to make them last longer — without affecting the toughness or ductility of the core.

LINDE OXYGEN • NITROGEN • HYDROGEN • RARE GASES AND MIXTURES • UNION CARBIDE PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNIONMELT WELDING

The words "Linde," "Union," "Prest-O-Lite," "Oxweld," "Haynes Stellite" and "Unionmelt" are trade-marks of Units of Union Carbide and Carbon Corporation.

Dowmetal's *Lightness*

Gives the Lift!

DOWMETAL is strong, tough, durable, and the easiest of all metals to machine.
It can be sand cast, permanent mold and die cast, forged, extruded and welded. It is available in sheet, strip, plate, standard and special extruded shapes.

A BREATH—THAT'S ALL the pressure needed to lift the DOWMETAL* disc that puts this valve to work controlling gas flow.

Manufactured by The Bryant Heater Company and designed to automatically control gas heating equipment, this diaphragm valve opens by gas pressure and closes by gravity. The DOWMETAL disc attached to the diaphragm is extremely light, thus assuring rapid positive operation of the valve.

In scores of other products—some of them like your own—DOWMETAL'S extreme lightness is lifting the penalty of useless weight. For with a third more lightness than aluminum, it combines one of the highest strength-weight ratios of any structural alloy.

Explore the possibilities that DOWMETAL'S lightness offers in your products. See how it can stimulate their sales appeal by making them easier to use. Or how, in moving or reciprocating machine parts, it can smooth out vibration, lower power costs and speed up an operating cycle.

To make these profitable discoveries, simply send for a copy of the illustrated DOWMETAL booklet, "Industry's Lightest Structural Metal." Do it today.

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MIDLAND, *Dowmetal Division,* MICHIGAN

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MAGNESIUM ALLOYS
INDUSTRY'S LIGHTEST STRUCTURAL METAL

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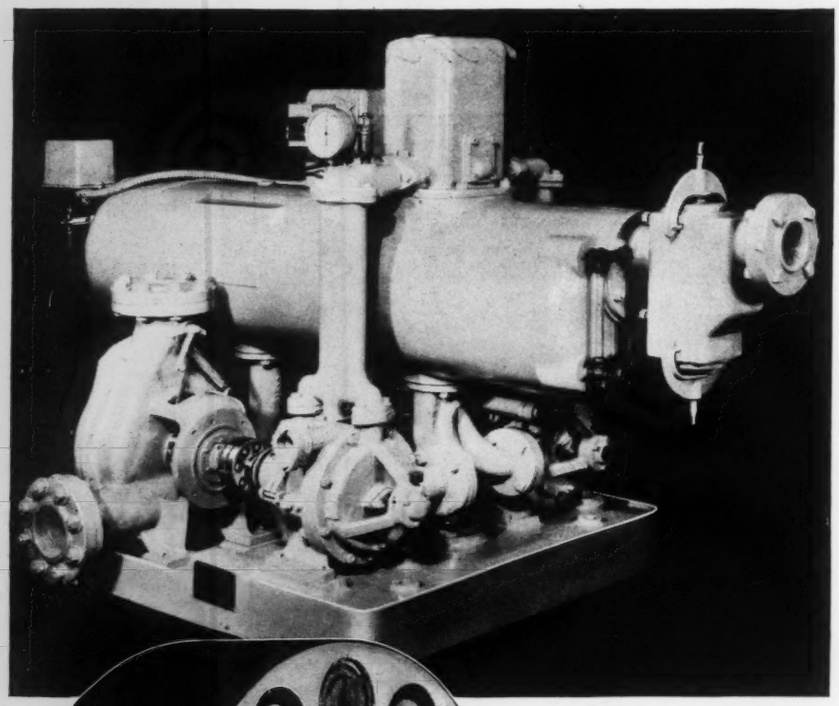
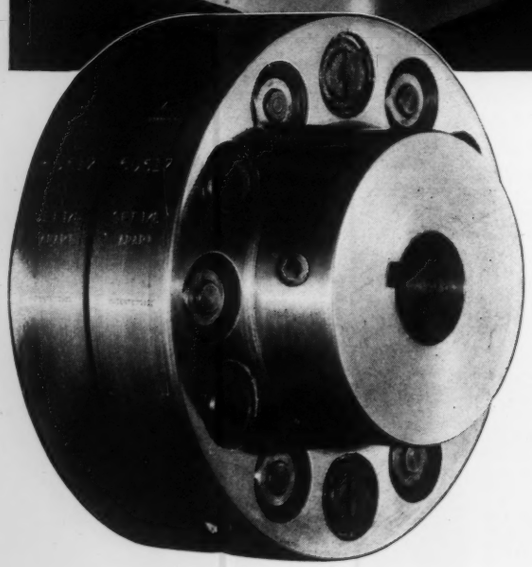
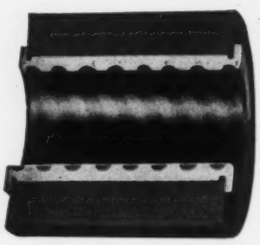
HOW Manufacturers are SAFEGUARDING PERFORMANCE AND REPUTATION *with* AJAX FLEXIBLE COUPLINGS



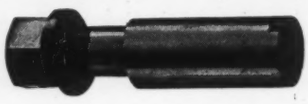


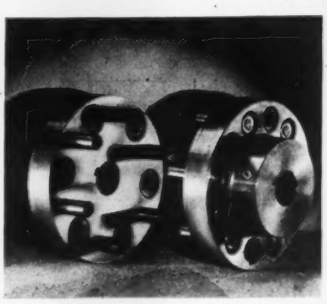
Photograph shows Ajax Type S Coupling used on Jennings Vapor Turbine Return Line Heating Pump built by Nash Engineering Company, South Norwalk, Conn. Ajax coupling connects steam turbine to two separate pump elements in a single casing. Turbine operates on the steam that it is pumping.

Design engineers are writing Ajax Flexible Couplings into their specifications and Bills of Materials as life insurance for the machines they build. Ajax Couplings combine positive rubber cushioned drive . . . resilient protection against misalignment . . . free end float . . . no backlash, no noise . . . no lubrication worries. Complete Ajax line provides correct type and size including Shear Pin Models. Write for Data Book.



Showing hardened alloy steel stud and cut away section of rubber bushing and flanged graphite bronze bearing.





Showing two Ajax Flange assemblies before mating. Installation and maintenance men customarily line up machines by means of coupling flanges, thanks to Ajax accuracy!

AJAX FLEXIBLE COUPLING CO.

102 ENGLISH STREET WESTFIELD, N.Y. INCORPORATED 1920

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Cincinnati, Ohio
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Milwaukee, Wis.
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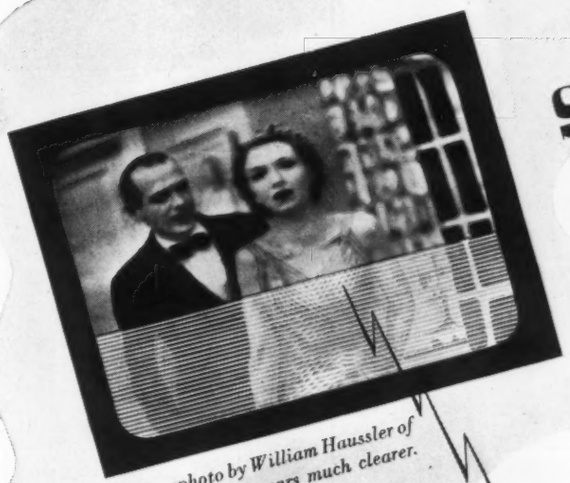
Philadelphia, Pa.
Syracuse, N. Y.
Pittsburgh, Pa.
San Francisco, Cal.
St. Louis, Mo.
Seattle, Wash.
Spokane, Wash.
Stuttgart, Ark.

Also Manufacturers of Reciprocating Shakers and Screens

SPOT of LIGHT travels 9000 MILES an HOUR to make Pictures at FAIR



Television image photo by William Haussler of N. B. C. Actual image appears much clearer.

Television, now under way on a commercial scale, uses tubes equipped with Nickel

THE newest marvel of the age is at last a reality! Eager New York and San Francisco World's Fair visitors and thousand of others, are *seeing by Television*. As fascinating as the sight itself, is the way the moving image is produced:

A tiny spot of light of constantly varying intensity swiftly traces 441 horizontal lines on the screen of the 12-inch television tube. Travelling 2½ *miles per second*, it completes the whole picture in 1/30th of a second, and so creates a moving image.

What produces this light, and so accurately controls its speed and intensity? In each case, delicate, precision-spaced parts made of Nickel. Why Nickel? Because this unusual metal most successfully meets the stringent needs of the job:

Absolute freedom from gas and a well-nigh perfect vacuum are essential for correct functioning of the television tubes. Glass envelope and metal parts are accordingly baked to free them of gas. Before sealing, the tube is pumped out and metal parts heated by induction to a bright red heat.

What happens if this devastating heat saps strength of the metal parts? They lose their precision spacing and accurate dimensions . . . and a costly tube becomes worthless scrap.

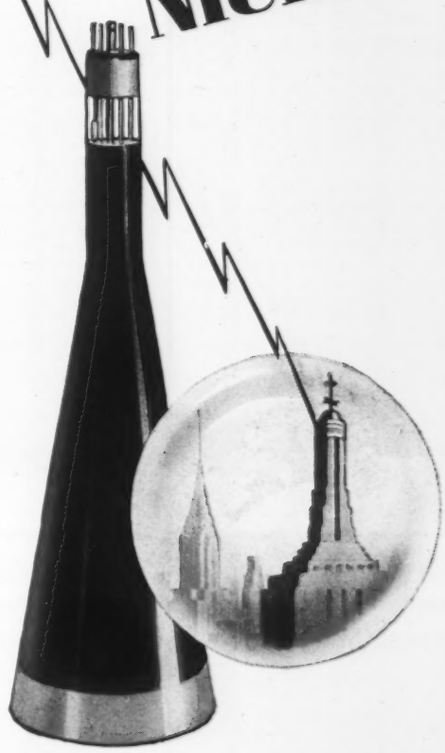
In addition to the high-temperature strength and low gas content required, Nickel offers other properties important in production of radio and television tubes: Rust proof and highly resistant to corrosion, it withstands repeated handling in forming and assembly. It also withstands the effects of chlorinated solvents used in cleaning parts. Another advantage: Nickel is easily formed by bending, drawing and other fabricating operations. Strong dependable joints are quickly spot-welded and free of harmful oxidation.

For these and other important reasons, Nickel for years had been the preferred metal for radio tubes. And now this tough, rust proof metal assumes the same position in television tubes.

Nickel is equally valuable in the manufacture of electrical, mechanical, chemical and other types of equipment. For information on how you can profitably utilize its unusual properties, address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street
New York, N. Y.

NICKEL



SEMS*

TRADE MARK REG. U. S. PAT. OFF.

A COMPLETE FASTENING UNIT . . . .
Ready for Application!

Pre-Assembled SHAKEPROOF Lock Washer and Screw

* SEMS is the registered trade-mark of Illinois Tool Works, manufacturers of Shakeproof Lock Washers. Only genuine Shakeproof Lock Washers are used in the manufacture of SEMS.

SAVE TIME . . . SAVE LABOR . . . SAVE MONEY

Save with SEMS—the proven Shakeproof fastening unit that immediately cuts production costs! SEMS bring you, in a single fastening unit, both lock washer and screw—pre-assembled and ready for application. SEMS save the time and trouble of putting lock washers on screws and stop the costly waste of dropped and wasted lock washers. SEMS make ordering easy by supplying both products as one unit, and keep inventories of both screws and lock washers automatically in balance. SEMS assure lowered labor costs and overhead charges because their use speeds up assembly—they aid control of product quality because each screw is provided with the correct size and type of lock washer—and no screw can be driven without a Shakeproof Triple-Action Lock Washer to protect it from vibration.

WRITE FOR TESTING SAMPLES

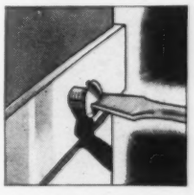
Try SEMS fastening units on your assembly job! A test run will convince you that SEMS offer a simple, yet practical way to cut costs—speed up production—improve performance! Free stock samples will be sent on request.

FREE SAMPLES!

LOOK AT THESE IMPORTANT BENEFITS

Lock Washer and Screw, pre-assembled and delivered as one unit.

Saves time and labor of putting lock washers on screws.



The correct size and type of Lock Washer for each size and type of screw.

No screw can be applied without Lock Washer to protect against vibration.

SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products Manufactured by Illinois Tool Works

2551 N. Keeler Ave., Chicago, Ill. In Canada: Canada Illinois Tools, Ltd., Toronto, Ont.

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"Fastening Headquarters"

SHAKEPROOF

Lock Washers . . . Thread-Cutting Screws . . . Self-Locking Set Screws . . . Locking and Plain Terminals . . . Spring Washers . . . Special Stampings

WHERE *Strength* COMES FIRST..

STEEL CASTINGS DO THE WORK

Here is the base plate, or turntable, of a heavy-duty power shovel — a single steel casting weighing a ton and a half.

The steel casting met every operating requirement in the finished shovel — high tensile strength, proper weight distribution without excess metal, ample hardness, rigidity, and resistance to shock, fatigue and vibration.

For the manufacturer, the steel casting saved money, because it required less machining and assembly time, no extra annealing or normalizing, minimum stock allowance for finishing and a smaller number of parts to handle. Although the casting itself is intricate, it required no revision of design for the foundryman.

Your market — everyone's market — demands a better product at lower cost. Steel Castings, large and small, will help you deliver it. Consult your local foundry, or write to Steel Founders' Society, 920 Midland Bldg., Cleveland.

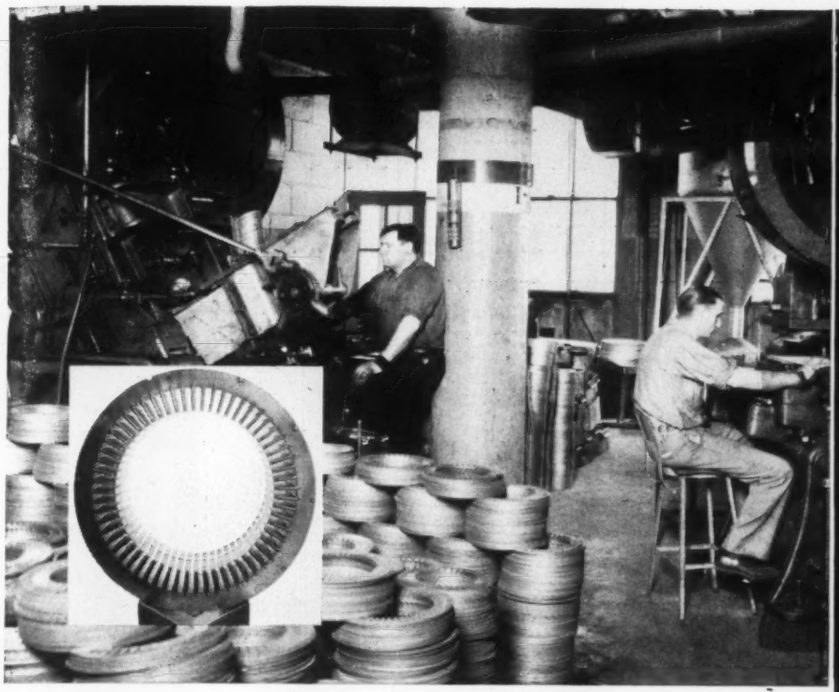
A Prominent Shovel Manufacturer says of Steel Castings...

"Superior physical properties, extra strength and hardness, better shock resistance, more economical, metal used to better advantage for strength and weight, less vibration, less gear noises."

— Quoted directly from this manufacturer's letter.

IMPROVE YOUR PRODUCT WITH

STEEL CASTINGS



PERFECT TEETH THAT WON'T CHEW
Cores Built to Eliminate Insulation Rupture

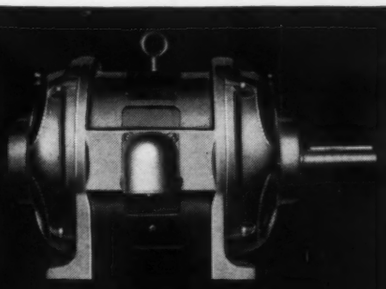
To attain the smoothly aligned slots and clean-cut laminations of Delco stators, a multiple-slot die is used in a group operation on all standard types. This method eliminates any inequalities that might cause partial rupture of insulation and eventual wiring failure.

Reinforcing ribs on the slot teeth prevent lamination teeth from fanning out in the stator winding process, and ample space has been allowed in slots for a sufficient quantity of highest quality insulation. In winding, the coil is completely closed to exclude metal particles or dust that might lodge and form a conductor.

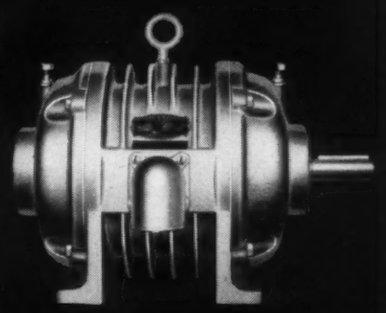
Delco cores are made of high-quality electric sheet steel, accurately ground on the outside, concentric with end-frame register. We invite you to investigate their workmanship, and ask you to *look within the motor you specify.*

EVERY DELCO MOTOR IS DYNAMICALLY BALANCED

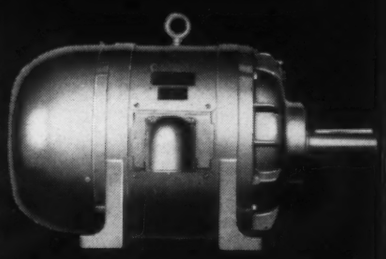
No motor leaves Delco Products that has not been dynamically balanced on a specially-designed balancing machine. Delco balances every motor. Each end of the rotor and shaft is first balanced independently, while the machine indicates exactly how much compensation is required and where it should be applied. After all adjustments have been made, the complete rotating assembly is given a final check. Delco motors assure satisfactory balance.



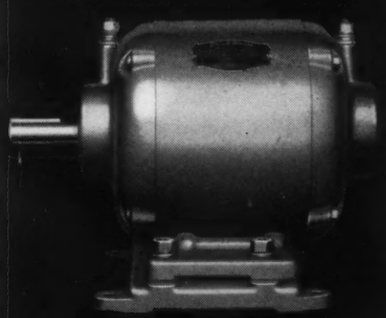
Open Frame, Sleeve or Ball Bearing



Totally Enclosed Ball Bearing



Totally Enclosed Fan-Cooled Ball Bearing



Fractional Horsepower Motor

• • •

Delco industrial AC motors are available in various types, possessing electrical and mechanical characteristics to meet practically every requirement.

Normal starting torque—normal starting current—high starting torque—low starting current—as well as high slip. Each type available in open frame, sleeve or ball bearing—totally enclosed ball bearing—totally enclosed fan-cooled ball bearing—also multi-speed motors. Electrical and mechanical modifications available. Delco motors comply with NEMA standards.

DELCO MOTORS

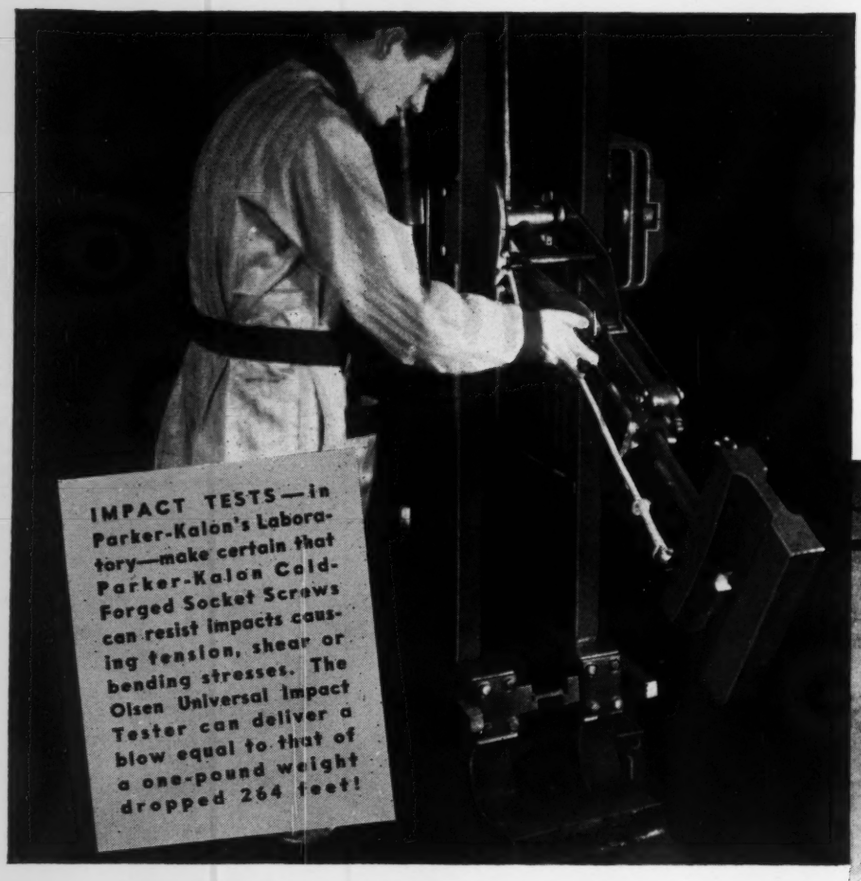
DIVISION OF GENERAL MOTORS CORPORATION

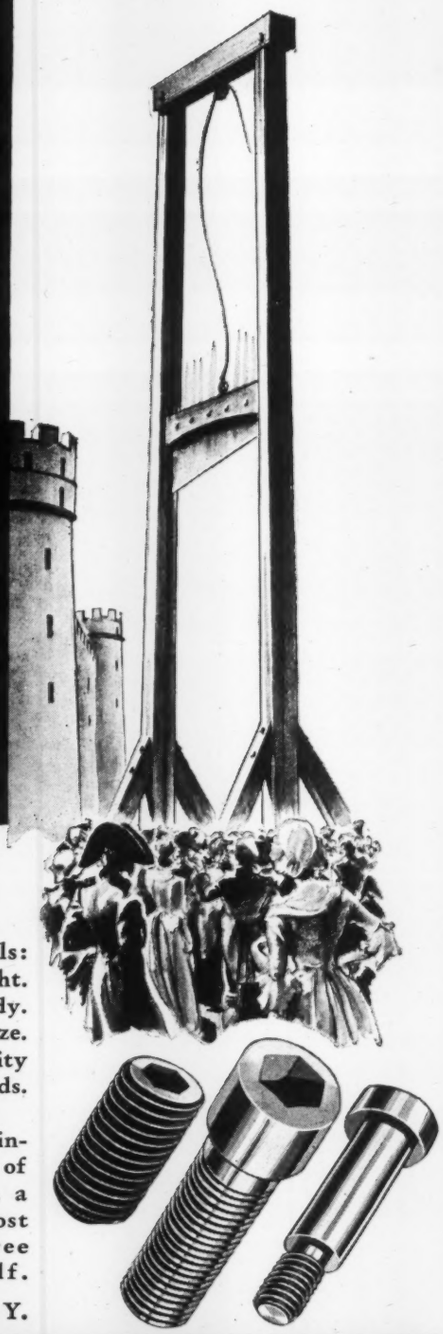
DELCO PRODUCTS DAYTON, OHIO

SOCKET SCREWS

"Hanged" and "Guillotined"

TO MAKE SURE THEY RESIST SHOCK LOADS!


IMPACT TESTS—in Parker-Kalon's Laboratory—make certain that Parker-Kalon Cold-Forged Socket Screws can resist impacts causing tension, shear or bending stresses. The Olsen Universal Impact Tester can deliver a blow equal to that of a one-pound weight dropped 264 feet!



"16 POINT QUALITY-CONTROL" Leads Critical Buyers to Demand PARKER-KALON

This impact test is only one of 16 check-ups on important characteristics of Parker-Kalon Cold-forged Socket Screws. In a laboratory without counterpart in the industry, quality is guarded by thorough tests and inspections covering:

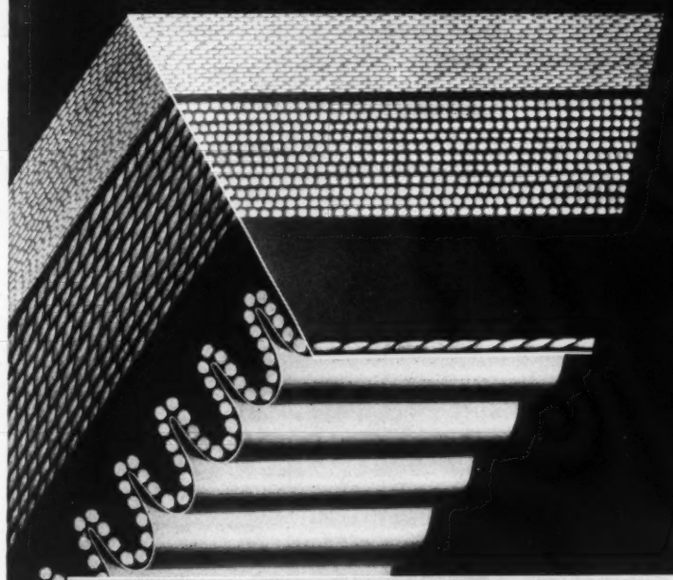
1—Chemical Analysis. 2—Tensile Strength. 3—Ductility. 4—Torsional Strength. 5—Ability to take Shock Loads under Tension. 6—Resistance to Shock Loads under Shear. 7—Hardness. In addition, there is a rigid inspection of these essentials: 8—Head Diameter. 9—Head Height. 10—Concentricity of Head to Body. 11—Socket Shape. 12—Socket Size. 13—Socket Depth. 14—Centricality of Socket. 15—Class 3 Fit Threads. 16—Clean Starting Threads.

In this way Parker-Kalon maintains a new higher standard of quality in Socket Screws . . . a standard that satisfies the most critical buyer. Send for free samples . . . . see for yourself.

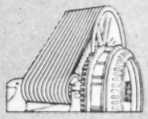
PARKER-KALON CORPORATION, 212 Varick Street, New York, N. Y.

PARKER-KALON Cold-Forged SOCKET SCREWS

For Space Saving Economy-DEMAND!-



DAYTON
Super-Flex
COG-BELTS
With DAYTEX CORD



FIELD EXPERIENCE CONFIRMS THESE LABORATORY TESTS WHICH PROVE THE OUTSTANDING SUPERIORITY OF DAYTEX CORD

Charts Show Laboratory Tests of Daytex Process Cord Versus Best Comparable Cord *Not* Daytex Processed

LESS STRETCH *Stretch test-cords.*

STRONGER *Tensile test-cords.*

LONGER LIFE *Belt flexing test.*

Super-Flex
Dayton
COG-BELT DRIVES WITH DAYTEX CORD

MADE BY THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

DAYTON'S FAMED TECHNICAL LABORATORIES—spent seven years of tireless research to develop these new Super-Flex Dayton Cog Belts, with Daytex Cord in their neutral axis section.

STEEL-LIKE IN STRENGTH—Daytex Cord is made from highest grade long-staple hard-bodied cotton. A bonding compacting agent removes, during the process of manufacturing, the non-essential oils and waxes from the individual fibres. As a result, the fibres interlock and form a stronger, yet more compact cord.

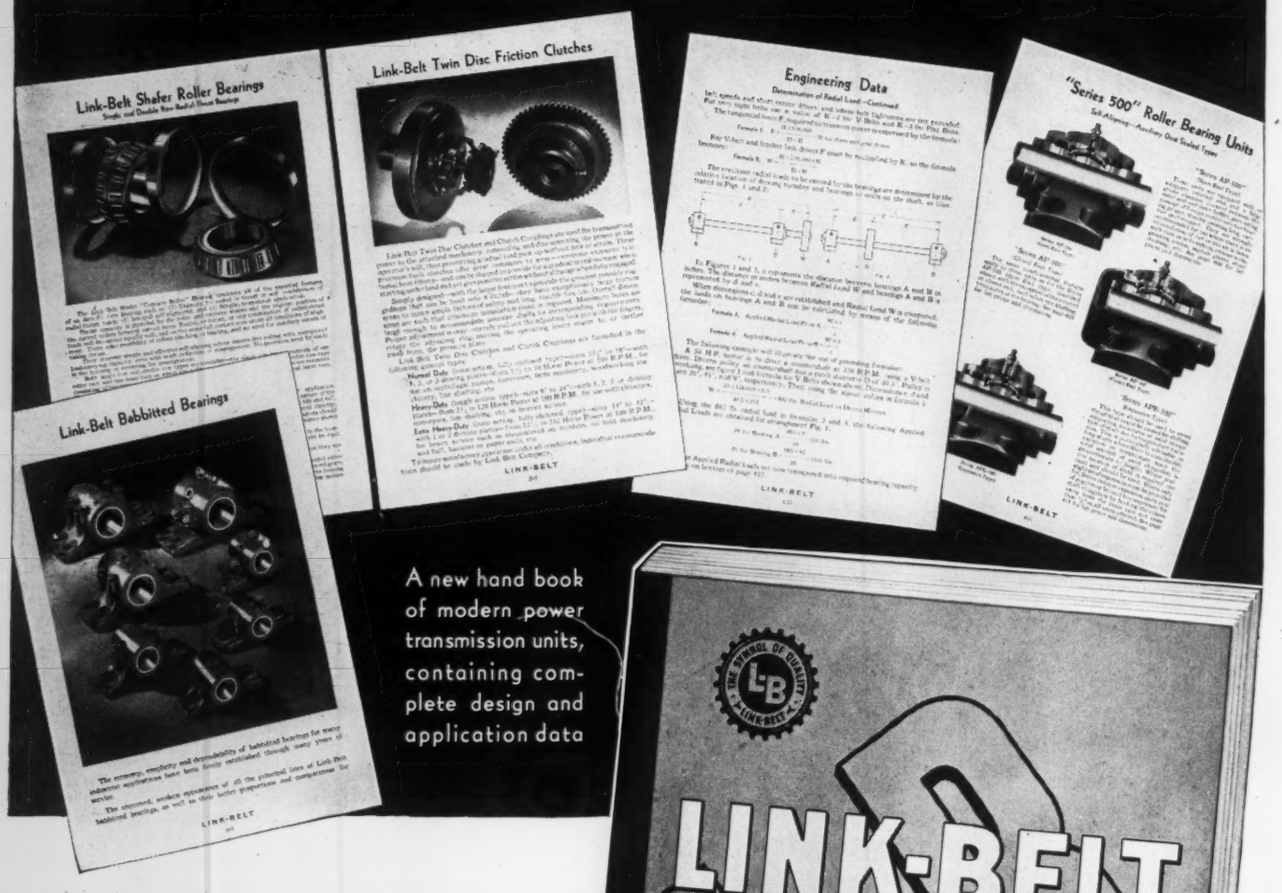
SMALLER IN DIAMETER—because of Daytex Processing this Super-Flex Cord averages 22% less diameter—it stands up under constant high speed flexing. It has greater tensile strength. Furthermore it has lower stretch and, due to interlocked fibres, has minimum tendency to become lifeless.

COOLER RUNNING—because highly developed rubber compounds are forced into and around each individual cord this denser Daytex Cord is made by patented Latexing and Calender Processes, which have been pioneered and constantly improved by Dayton for 19 years.

SPACE AND MONEY SAVING—Super-Flex Dayton V-Belts work on short centers—take less space—save money and require fewer adjustments. Outstanding in basic design, Dayton V-Belts are built to bend with patented cog construction. Call your local Dayton distributor or write for catalog and data.

THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO

SEND FOR THIS NEW 272 PAGE DATA BOOK


Link-Belt Shafer Roller Bearings
Link-Belt Twin Disc Friction Clutches
Engineering Data
"Series 500" Roller Bearing Units
Link-Belt Babbitted Bearings
A new hand book of modern power transmission units, containing complete design and application data
LINK-BELT
power transmission equipment
BOOK NO.
1600

Between the covers of this new book are presented in convenient, compact form, complete engineering and reference data on—self-aligning anti-friction ball and roller bearing units, newly designed for greater life . . . unmounted bearings for various industrial applications . . . babbitted bearing units for every service . . . welded steel base plates . . . take-ups . . . friction and jaw clutches, including the newly-acquired Twin Disc line . . . Cast and cut tooth gears . . . steel split and cast iron pulleys . . . safety collars . . . couplings, both flexible and rigid . . . drop hangers and hanger bearings . . . grease fittings . . . shafting—the latest designs of the leading manufacturer of power transmission equipment. 272 pages of illustrations, dimensions, weights, list prices, engineering information, cross-indexed for the convenient use of design engineers and plant managers. Return the coupon for your copy.

LINK-BELT COMPANY, 300 W. Pershing Road, Chicago, or 2045 W. Hunting Park Ave., Phildelphia

Please send copy of new Power Transmission Book No. 1600 7770-A

Name_____ Firm_____

Business_____

Address_____ City_____ State_____

Pieces of Eighty

Excerpts from a Book about a History-making Invention

#16 A mechanically cleaned Cuno installed on the job (described in book) made an 18% reduction on rejections.

#59 A *continuously cleanable* Cuno, handling 86 gallons per minute of (described) fluid, was checked after 3 years in service and found perfect.

#60 The engineering department of one manufacturer reported their cost of (described) was reduced *seventy-five per cent* after their Cuno filter was installed.

#71 What did Cuno do for Colonel Lindbergh?

Read about these extraordinarily interesting cases in our new book. It'll open your eyes to the flaws in old fashioned stop and go straining . . . and show you how to save money to boot. Use the coupon below. The book's free.

ONE quick revolution cleans the Cuno Auto-Klean filter — without interrupting the flow. It's the Cuno principle of edge filtration, giving *continuous* protection.

There is no need for expensive duplex installations — nothing to do but install — and run.

Other Cuno *continuously cleanable* filters remove extremely fine particles and abrasive solids as small as .001". You name your conditions. We have the filter to fit them, even if they include air or gases. Get Cuno *continuous* savings.

Cuno Engineering Corporation
267 South Vine St.
Meriden, Connecticut
Please send me, free, "80 Ways to Make More Money."

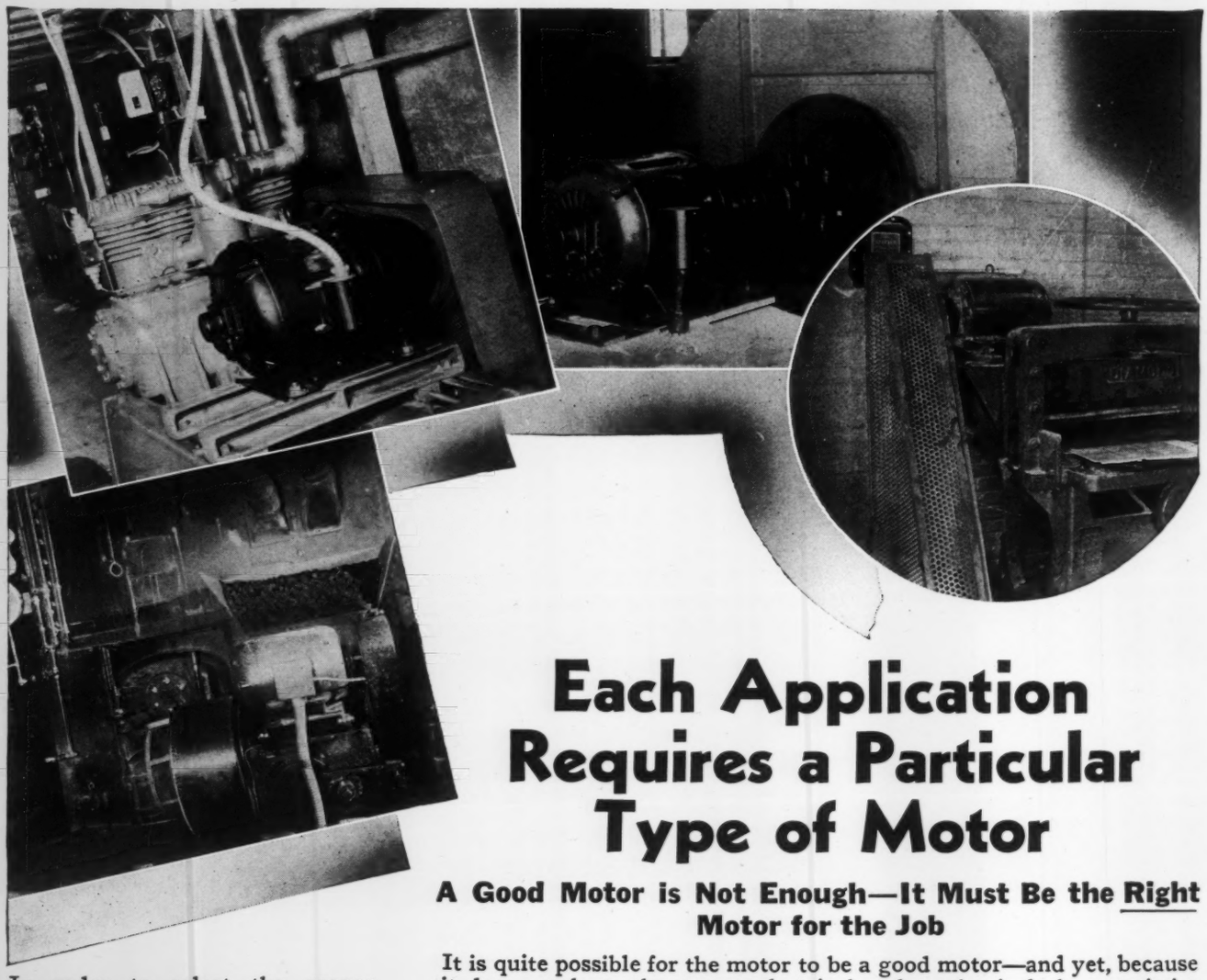
Name.....

Company..... City..... State.....

Street.....

avoid stop and go with CUNO *Filters*

CUNO ENGINEERING CORPORATION ★ MERIDEN, CONNECTICUT



Each Application Requires a Particular Type of Motor

A Good Motor is Not Enough—It Must Be the Right Motor for the Job

It is quite possible for the motor to be a good motor—and yet, because it does not have the proper electrical and mechanical characteristics for that particular job, it may prove troublesome and short-lived. Some applications operate continuously—others intermittently. Some require high starting torque, others may be required to meet rigid starting current requirements.

The selection of the right type of motor is a task that should be delegated to the motor manufacturer. Wagner builds such a wide variety of types and sizes of motors that usually there's a motor already available to exactly meet the requirements. And Wagner motors are dependable. They give continuous trouble-free service, requiring very little maintenance other than periodic inspection and lubrication. Their construction features and mounting dimensions are such as to be readily adaptable to the design of the equipment they operate.

Wagner motors have the necessary electrical and mechanical characteristics to adequately and efficiently meet the starting, running, and overload requirements of your equipment.

Let a Wagner sales engineer assist you in your motor selection. He is a factory-trained motor-expert and can make unbiased recommendations as to the right motor for each job.

Write for Bulletins 177, 179, and 182 which completely describe and illustrate Wagner motors.

M39-14B

In order to select the proper motor, the following points should be considered.

Load Cycle

What maximum and minimum horsepower is involved, and what is the probable duration of each?
What are the maximum starting torque requirements?
Is the duty cycle continuous or intermittent, and what method of control and overload protection is contemplated?

Power Supply

A.C. or D.C., and frequency if A.C.
Voltage.
Phase.
Special Starting Current limitations, if any, imposed by the power supplier.

Speed Characteristics

Single constant speed.
Variable or multispeed.

Mechanical Construction

Is open type motor acceptable, or should Splash proof,
Totally-enclosed Fan-cooled, or
Explosion-proof motor be used?

Motors
Transformers

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

Fans
Brakes

what a PHILLIPS SCREW thinks about

Well, I just got driven home as smoothly and comfortably as though I were riding in a limousine.

A short while ago I was in a box with some other Phillips Recessed Head Screws and then this fellow picked me up and tucked me onto the end of a driver. I hung on for dear life, and even when he reached downward to get into driving position, I didn't fall off. No ending up in a trash can for me.

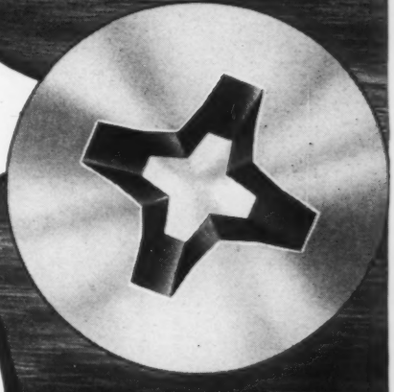
The power driver turned pretty fast, but I kept on the straight and narrow, refusing to go crooked. It didn't hurt a bit. The tapered driver fit so snugly into the recess that the operator didn't have to use much pressure. I went through the material as though it were butter.

Despite the dizzy pace, I didn't lose my head (of course, my family are famous for keeping their heads about them), and there was none of the shearing action that causes burrs on slotted screws.

So here am I, safe and sound, and up to my neck in work. I have a secure grasp on things and I'm certainly not the type to go on the loose. And if anybody says I'm *tight*, that's all right because I *am* tight. And if *you* want to be tight with *money*—I'd advise you to look up the rest of my family. Our coat of arms reads, you know, "It Costs Less to Use Phillips Screws."

P.S. You can get some pretty interesting information on how thousands of firms have lowered assembly costs. Write for free folder to any of the firms listed below. No obligation.

If you knew
YOU MIGHT CHANGE YOUR MIND ABOUT FASTENING COSTS



This Booklet will help your plant to cut fastening costs and improve assemblies. Address one of the firms below for free copy.

PHILLIPS RECESSED HEAD SCREWS

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

AMERICAN SCREW CO., *Licensor*
Providence, R. I.

CHANDLER PRODUCTS CO.
Euclid, Ohio

CONTINENTAL SCREW CO.
New Bedford, Mass.

CORBIN SCREW CORP.
New Britain, Conn.

THE LAMSON & SESSIONS CO.
Cleveland, Ohio

NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

PARKER-KALON CORP.
New York, New York

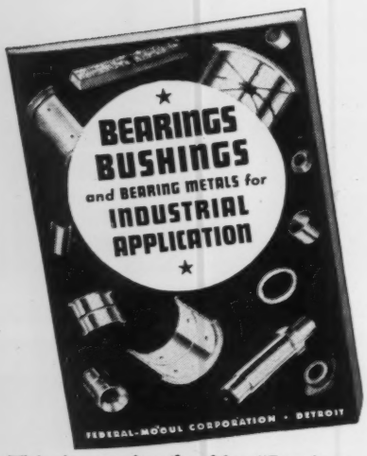
PHEOLL MFG. CO.
Chicago, Illinois

RUSSELL, BURDSALL & WARD BOLT & NUT CO.
Port Chester, N. Y.

SCOVILL MANUFACTURING CO.
Waterbury, Conn.

IT COSTS LESS TO USE PHILLIPS SCREWS

MILLIONS OF BEARINGS AND BUSHINGS EACH YEAR... OUR *experience* IS AT YOUR SERVICE



This interesting booklet "Bearings, Bushings and Bearing Metals for Industrial Application" will be sent free of cost when requested on your business letterhead.

Small runs are an important part of Federal-Mogul's annual volume of production, which includes bearings, bushings, bearing parts, bronze bars and babbitt metals. Forty years' specialization and wide variety in bearing products manufactured, assures wide, practical experience in design, development and ability to produce. Federal-Mogul bearings are supplied for all types of installations, ranging from tiny electric motors to steam shovels, and including washing machines, vacuum cleaners, automobiles, aircraft, compressors, etc. This experience has enabled us to effect important improvements in bearings for many users. The application of insert precision-type bearings in place of poured bearings, thus reducing cost, increasing bearing life and solving an awkward replacement problem, is a typical example. To any manufacturer or engineer whose job is the development of bearings for new equipment, or modernizing old, this bearing consultation service is offered, without cost or obligation. If you wish, send us blueprints. We are glad to consult with you.

FEDERAL-MOGUL CORPORATION

Pacific Division: 210 Van Ness Ave. S., San Francisco, Calif.

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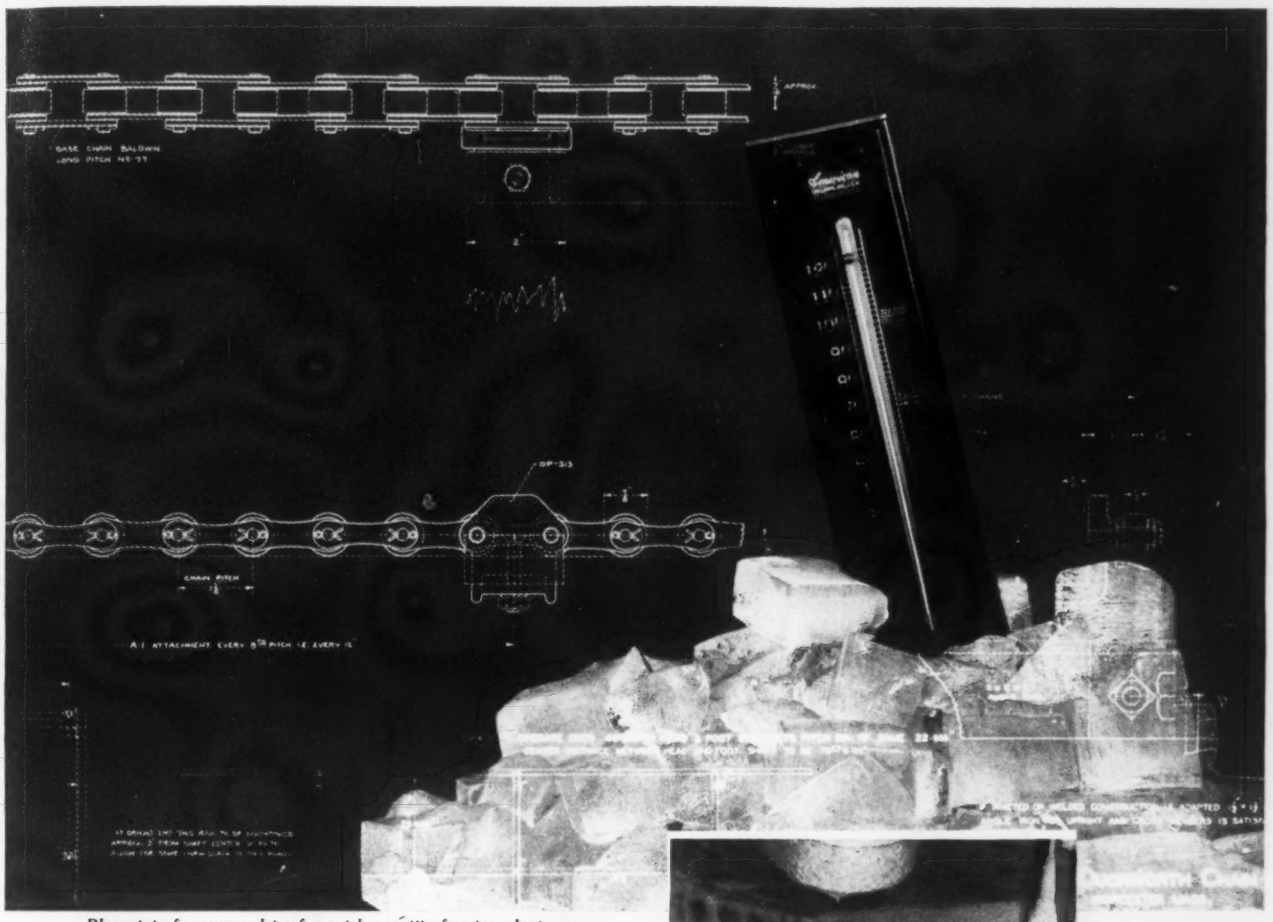
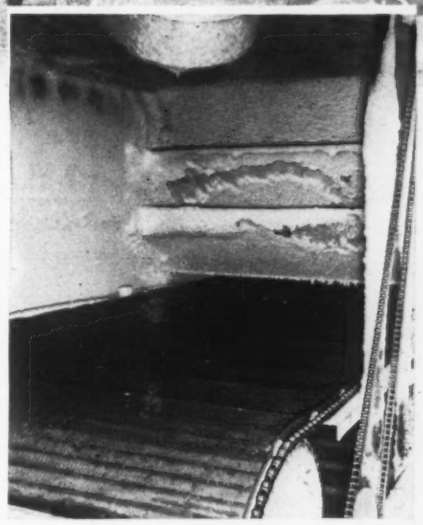


Blueprint of conveyor drive for quick quantity freezing plant.

Planning for 20° BELOW ZERO

A harried Port Authority needed quick practical freezing facilities to build export fruit and vegetable tonnage. Baldwin Engineers were called in and designed this conveyor system to meet the need. Features: Oversize rollers support 4 200-foot lengths of chains, thus preventing frictional wear; standard attachments carry screen support; and a special lubrication device *plus* the inherent qualities of Baldwin precision-machined roller chain, takes care of the recurrent exposure to sub-zero temperature.



The finished conveyor. Note frost produced by sub-zero temperature. Standard Baldwin Roller Chain drives main conveyor sprocket too.

You may have a conveying or drive problem that can be handily solved by using the experience Baldwin Engineers have obtained in serving all industry for thirty odd years. Call the B-D Man.

BALDWIN-DUCKWORTH

BALDWIN-DUCKWORTH CHAIN CORP.
SPRINGFIELD, MASS.
Factories at
Springfield and Worcester
Mass.

Smooth flight on the "MAGIC CARPETS"

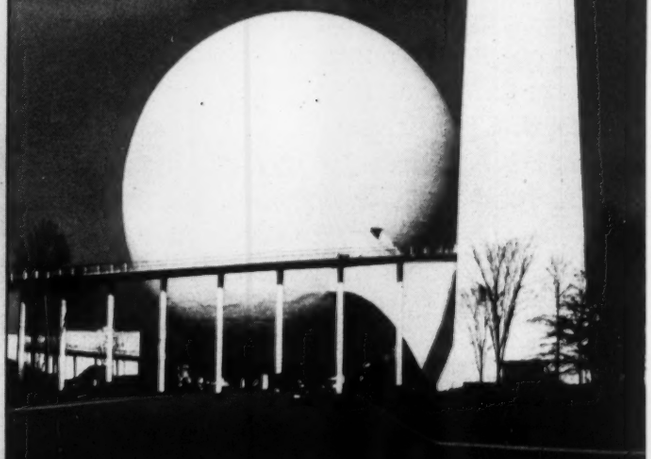
or rotating platforms, in the Perisphere at the New York World's Fair 1939, is assured by

DE LAVAL WORM REDUCTION GEARS

EACH of the two platforms travels on 64 wheels having accurately machined treads and ball bearings, to give the spectators the impression of floating on air. The upper platform, which is 112 ft. 5 in. in diameter to the outer rail, is driven by four 1750 r.p.m. motors through 119.583 ratio gears to make one revolution in 6.28 minutes; and the lower 102 ft. 5 in. diameter platform is similarly driven through four 133.25 ratio gears. Both operate so smoothly that no sound or jar is noticeable.

Write for booklet on

"INDUSTRIAL APPLICATIONS OF WORM GEARS".



DE LAVAL STEAM TURBINE CO., TRENTON, N. J.

1115

Announcing

FORMEX

A NEW Magnet Wire Developed by General Electric

FORMEX identifies a new G-E magnet wire insulated with a synthetic resin of the vinyl acetal type.

The result of ten years' research, far different in many properties from any other magnet wire, Formex wire offers new possibilities for making far-reaching, profitable improvements.

Physically, Formex wire is outstanding. It retains the high dielectric strength of conventional enameled wire and has, in addition, the strong physical properties of such fibrous coverings as cotton, silk, and paper. It thus allows more copper to be put into less space.

A Long-time Problem

Most users of magnet wire will appreciate what the problem involved: They know that enameled wire is satisfactory electrically for most applications *if* it can be wound into coils without damage to the film. But often it cannot be. The hazards in winding make necessary a fibrous covering—which serves chiefly as mechanical protection—over the enamel. Such a covering takes up space and has other shortcomings. How to get rid of it?

Ten-year Research Program

As a large user of magnet wire, General Electric had long been trying to solve this problem.

Nearly ten years ago, a broad, carefully planned program was mapped out and work was begun. It passed through many phases, each of which followed a definite pattern and contributed its essential part to the continuous progress of the whole.

The earliest indications of success were the first wires coated with certain synthetic resins of the vinyl acetal type. Next came an economical method of manufacture. Efforts, in the several years that followed, were directed toward making further detailed improvements and reducing costs. Today, success is at hand.

In all this work, contributions were made by our research, engineering, and factory laboratories, by engineering and kindred departments. Formex wire stands as a noteworthy example of co-operative research and development work.

Result: New Properties

The advantages of Formex wire can be told quickly: The physical toughness and abrasion resistance to stand the most severe tests . . . a flexibility never before thought possible in an enamel-like wire . . . resistance to most oils, to many solvents, to refrigerants, and to similar harmful agents . . . and the ability to withstand heat, aging, and shock.

Warrants Study to Find Most Profitable Uses

But the ultimate benefits from the use of Formex wire will have to be calculated. What economies will it make possible in high-speed winding? How much space—and cost—will be saved by the omission of cotton, silk, or paper? What of the savings in impregnation treatments? What will be the effects of fewer factory rejections and of overall improvements in quality of product?

Only study will reveal the answers. Naturally, all the applications of Formex wire have not yet been uncovered. In general, it can be used profitably to replace such bulky types as cotton-, silk-, or paper-covered enameled wire. But its field of usefulness has not yet been completely delineated.

For these reasons, we should like to have our magnet-wire specialists work closely with manufacturers' engineers in order that all the outstanding properties of Formex wire may be fully realized. More detailed preliminary information will gladly be furnished. Address the nearest G-E sales office or General Electric, Dept. 6—201, Schenectady, N. Y.

GENERAL ELECTRIC MAGNET WIRE

ALWAYS THE RIGHT TYPE FOR EACH JOB

GENERAL ELECTRIC

5216-168

Topics

AGITATION for alteration in the patent laws began last year when a bill was introduced into congress proposing to throw patents open to interested parties upon payment of royalties. Late in 1938 the Temporary National Economic ("Monopoly") committee began its work, commencing with hearings on patents. Most concrete result to come out of the TNEC's hearings has been a proposal to set up a Circuit Court of Appeals for Patents. A lesser change would attempt to penalize undue delay between application and issuance of patents, by letting a patent run for not more than 20 years from application or for 17 years after it is granted, whichever is longer. But advocates of retaining the present patent laws are not taking these proposed changes lying down. The American Engineering council, in conjunction with the National Association of Manufacturers and the National Industrial Conference board is making a study of the patent situation through the medium of a questionnaire sent to engineers and inventors. Theme of the questionnaire is the problem of whether or not patents have been withheld from use and why, and of whether or not they have been involved in litigation. Fair comprehensive answers to these questions, from persons in direct contact with inventions, will contribute much more to a solution of the patent problem than political partisanship.

◆

THE old order changeth, certainly, and alterations have even extended to that time-honored tool of engineers, the slide rule. To facilitate the work of the radio engineer, the Broadcast Development department of the Bell Telephone system has designed a slide rule similar in appearance to the duplex rule with the usual A, B, C, CI, D and trigonometric scales on one side. An added designation, "db," has been added to the conventional L scale, and is used for the conversion of ratios of power, voltage, and current in reference to the D scale. The F or frequency scale is also on the first side. On the reverse side are a number of special scales arranged for solving problems related to transmission of radio waves over a plane earth. A number of special problems can be solved with this rule.

◆

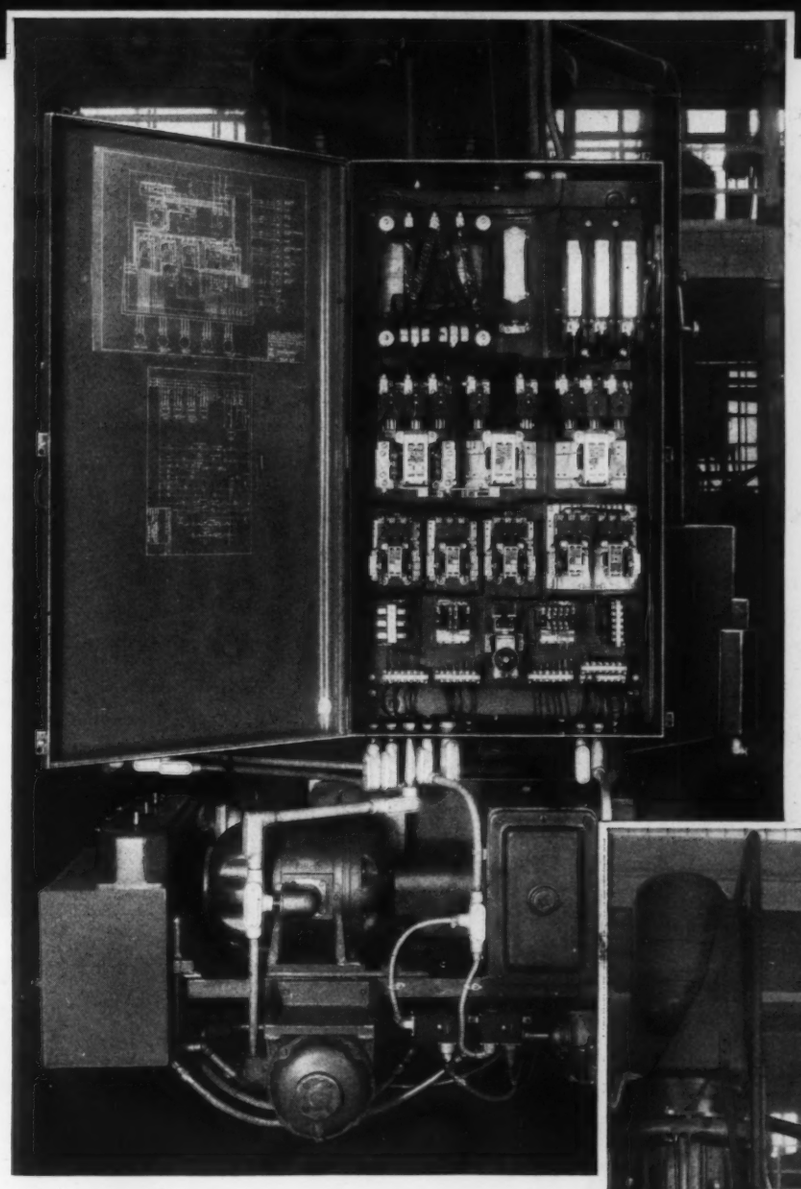
A YEAR ago *M.D.* discussed the Ford Motor Co.'s experimental work in casting gear blanks in centrifugal dies, which was a phase of Ford's general trend lately to cast parts as brought out in the article, "Ford Turns to Castings," in the issue for October, 1938. Ford has now announced that centrifugally-cast truck ring gear blanks are in regular production, with car ring gear and the transmission cluster gear soon to follow. Advantages claimed: Greater strength, lighter weight, faster production. Other automotive interests are also experimenting with castings for parts long relegated to other methods.

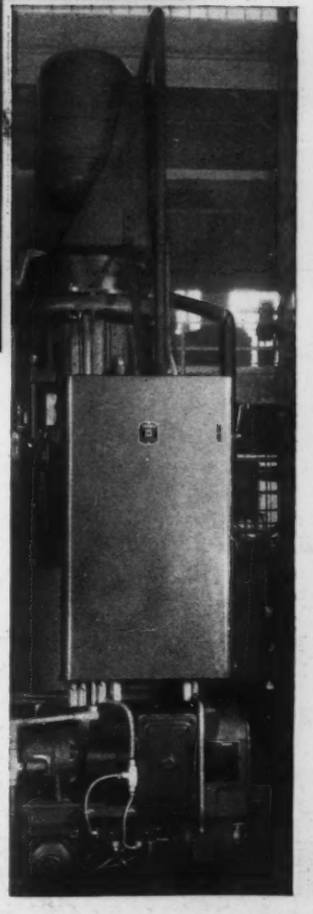
◆

EMPHASIS nowadays on vibration reduction, lowering of noise levels, lessening of lubrication requirements and other factors has increased interest in application of springs and mechanical rubber to machines. A "torsilatic" spring developed by the B. F. Goodrich Co. combines rubber and springs into a unit on which results are being observed closely by automobile men, although its potential applications are claimed to be much wider. Torsion-type, the torsilatic spring has an inner shaft surrounded by an annular layer of rubber, with a metal shell on the outside. The rubber is bonded under high pressure to both shaft and shell.

FOR AUTOMATIC MOTOR CONTROL

Rely on





Specialized machine tools for high speed production require the best of automatic electric motor control. This Contin-U-Matic chucking and turning machine is operated by five motors. Each must be controlled to perform its duties in the automatic production cycle—reliably, safely and in proper sequence.

The Square D control panel is built from standard vertically operated automatic starters and magnetic contactors. They automatically start, stop and reverse the motors. Square D pressure switches control the oil lines for hydraulic chucking and forced lubrication.

This panel contains three sizes of automatic starters, all of uniform design and individually mounted on steel plates; an economical, compact, neat assembly.

Square D engineers are experienced in the design of special machine tool control. They are glad to cooperate with machinery manufacturers and machine users in solving motor control problems.

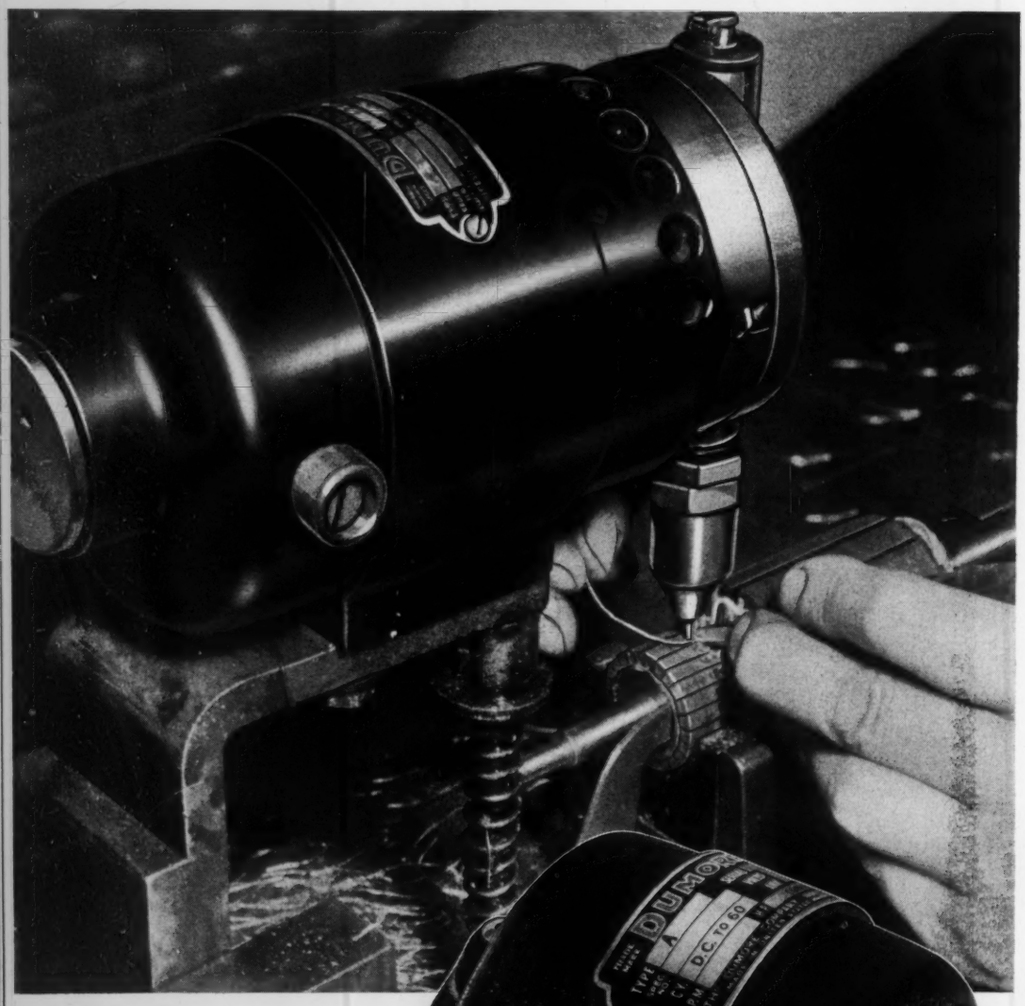
CALL IN A SQUARE D MAN

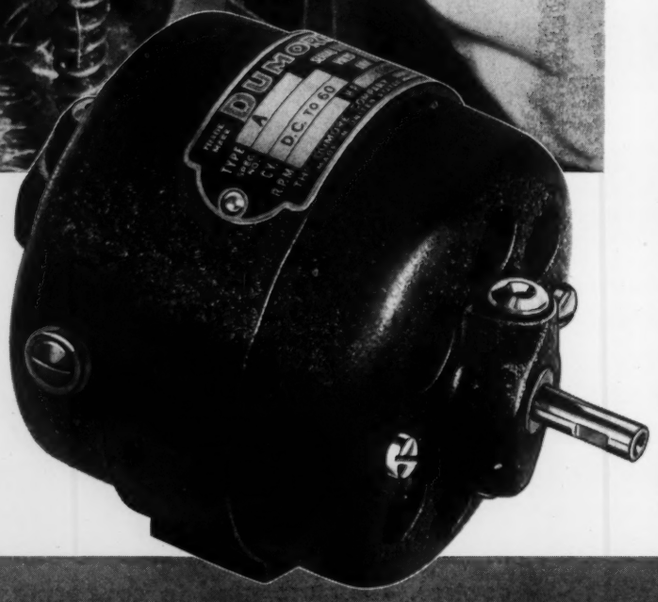
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

THERE ARE 5 pecks IN A DUMORE BUSHEL





Armature leads in a Dumore motor form perfect electrical contact, permanently, because they are swaged by a specially developed process and then soldered. This is just one of many steps taken to build in extra "power hours."

No matter how you measure value, you'll get more motor for your money in a Dumore... more of the thing for which you buy motors ... POWER. The reason you get more power is not just an accident. Dumore's manufacturing methods perfected over 25 years, were deliberately planned to *build* many hours of extra power into fractional horsepower units.

Here's how it's accomplished: (1) Armatures are dynamically balanced to eliminate vibration; (2) Commutators are ground concentric with bearings for longer life; (3) Windings are expanded at high speed, then sealed; (4) Leads are swaged by special process for 100% electrical contact; (5) Every motor is inspected five times during manufacture and run-in to seat brushes properly. Check into these facts for yourself, then let a Dumore engineer consult on *your* power problem. Write today.

THE DUMORE COMPANY
Dept. 129-G Racine, Wis.

SPECIFICATIONS TYPE A MOTOR
Series {universal} 0-60 cycles; h. p., 1/30; full-load speed, 7000 r. p. m.; volts, 115; amperes, .72; watts input, 69; duty, continuous; temperature rise, 40 C.; cooling, internal fan; bearings, composition bronze; housing, cast iron; weight, 3 lbs.

DUMORE MOTORS

FOR *Extra* POWER HOURS

MACHINE DESIGN

Injection or Compression Molding?

By J. Delmonte

METHODS of molding have an important bearing on the design of plastic parts and an understanding of the technique of production will enable the designer to produce the best results. In the past, this consideration was not deemed of great importance because most of the molding operations were of the direct compression molding type. Development of transfer and injection molding has somewhat altered this situation and design possibilities in molded plastics

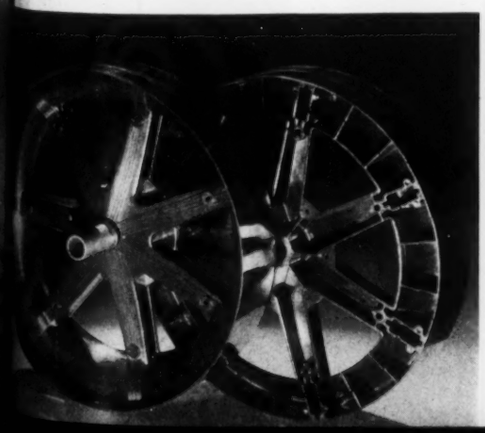


Fig. 1—Left—Among the largest pieces molded by the conventional hot compression method is this card-filing unit. Fig. 2—Right—Tilting head press, compression type, may be utilized for multiple molding operations

have been greatly extended. While the selection of the method of molding for a given design is usually the problem of the custom molder, the designer should know in advance which method is to be pursued, so that the finished design may be governed accordingly. Particular note should be made of the limitations of the various methods.

The two best known methods of molding plastic materials are compression and injection molding. Since the first commercial development of plastic materials, compression molding has always been a fundamental technique in the conversion of molding powders into parts. In the mold the application of heat and pressure will reduce the plastic material to a mobile medium capable of reproducing the finest details in the mold cavity. Materials are loaded into the cavity and compressed when the mold halves move together and the force plug enters the chase. Thermosetting materials such as the phenolic and urea resins will flow, take a set, and cure during the molding cycle. They may usually be ejected from the cavities while still hot. Thermoplastic materials such as cellulose plastics and acrylic resins will flow but will not set until the mold has been chilled below the softening point of the material. No cure is required of these materials in the mold.

Compression molding, while suited to the mass production of molded articles of thermosetting materials, was often uneconomical for the more costly thermoplastic materials which required a much longer molding cycle. Hence injection molding was developed wherein the molding cycle for thermoplastic materials was shortened to a period much less than that required for thermosetting types. In injection molding the material is reduced to a plastic state in a chamber external to the mold and injected into a chilled mold through a nozzle, solidifying in a short time. For many parts this cycle is conducted automatically, requiring minimum attention on the part of the operator.

Provisions for fully automatic operations are incorporated into modern injection molding presses, a typical example being the Reed-Prentice 8-ounce machine shown in *Fig.* 4. The molding material in granular form is loaded into the hopper above the machine and delivered to the plasticizing chamber on each cycle. In this particular machine, molding or injection

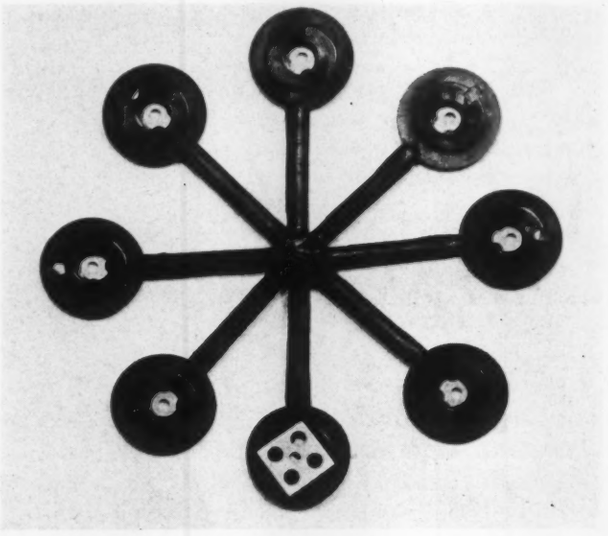


Fig. 3—Thickness of injection molded sections seldom exceeds ⅛-inch. Too great thickness enhances tendency toward shrink marks and incompletey filled cavities

pressures and mold clamping pressures are developed from horizontally disposed cylinders. The semiautomatic hydraulic, compression molding press may be compared with this type from an operating viewpoint. A tilting head press for molding telephone handsets, made by the French Oil Mill Machinery Co., is shown in *Fig.* 2, and *Fig.* 5 shows a self-contained molding press of Hydraulic Press Mfg. Co. Pressures are developed vertically between the platen of this type of

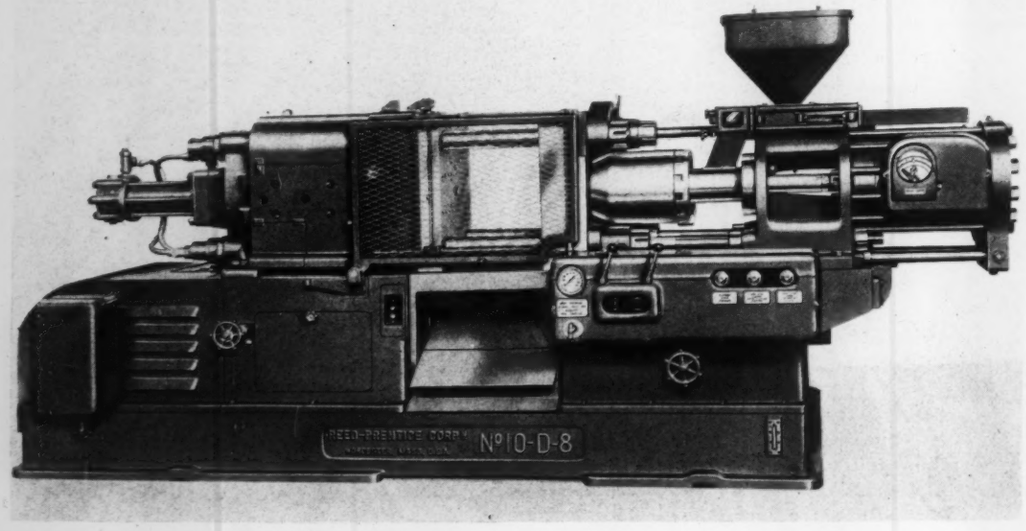


Fig. 4—Fully automatic eight-ounce injection molding press, molding material in granular form being loaded into the hopper above the machine

Comparison of Molding Methods

Operation	Compression Molding	Transfer Molding	Injection Molding	Cold Molding
Materials usually used	Thermosetting or thermoplastic	Thermosetting	Thermoplastic	Thermosetting or thermoplastic
Method of loading	Manual	Manual	Automatic	Manual
Form of charge	Preforms or powder	Preforms or powder	Granules	Powder
Where material is plasticized	Within mold	Outside mold in separate chamber	Outside mold in separate chamber	In separate oven after molding
Amount of material handled per cycle	Unlimited	Unlimited*	Largest machines handle up to 32 oz.	Limited by amount that will cohere
Pressures developed	1000 to 8000 p.s.i.	1000 to 8000 p.s.i.	3000 to 30,000 p.s.i.	2000 to 10,000 p.s.i.
Temperature of mold	Hot	Hot	Cold	Cold
Ejection of pieces	Automatic	Manual	Automatic	Automatic
Time of molding cycle	½ to several minutes	1 to several minutes	Several cycles per minute	Several cycles per minute
Inserts that can be handled	Symmetrical shapes and well supported inserts	No limit	No limit	Not introduced
Typical examples of articles molded	Radio housings Small knobs, handles Molded gears	Switch parts with inserts Spark plug fittings Coated die castings	Plug bodies Switch parts Chemical conduits	Handles, knobs Bobbins Auto steering wheels, steel core
Tolerances between mold parts	Fair	Good	Good	Poor

**Though the amount of material handled in compression or transfer molding is limited only by the press capacity, which runs into very high figures, there are limitations upon amount of material for transfer molding because of greater flow requirements*

press, and the molds are closed at the time the material is compressed, the force being derived from the hydraulic cylinder. For small molded articles some presses have been made automatic in operation, differing from the semiautomatic types in that the molds are loaded automatically from a hopper and cleaned out automatically, after ejection.

Although injection molding methods were developed for the economical production of articles from thermoplastic materials, certain other advantages became apparent as the technique was developed further. Most important of these was the molding about large and complicated inserts, and the formation of deep side and oblique holes in the molded article, design features often eliminated compression molding.

It is well known that efforts to mold about horizontal coring pins unsupported for any distance are beset with problems in standard compression molding because of breakage and displacement of coring pins during closing of the molds. To overcome some of these limitations transfer molding was developed, drawing upon some of the basic features of injection and compression molding. As in injection molding, the molding powders are plasticized in a chamber outside of the mold cavity and flowed in through a gate to a mold. However, transfer molding operations are conducted in a compression molding press and materials are loaded manually into the plasticizing chamber. As thermosetting materials are generally employed in transfer molding, the molds are kept hot and designed integrally with the plasticizing chamber. The advantages of using molds of this construction are many, and highly complicated designs and a wide variety of miscellaneous inserts are molded without difficulty. Highlights of injection, compression, and transfer molding are compared in the table above.

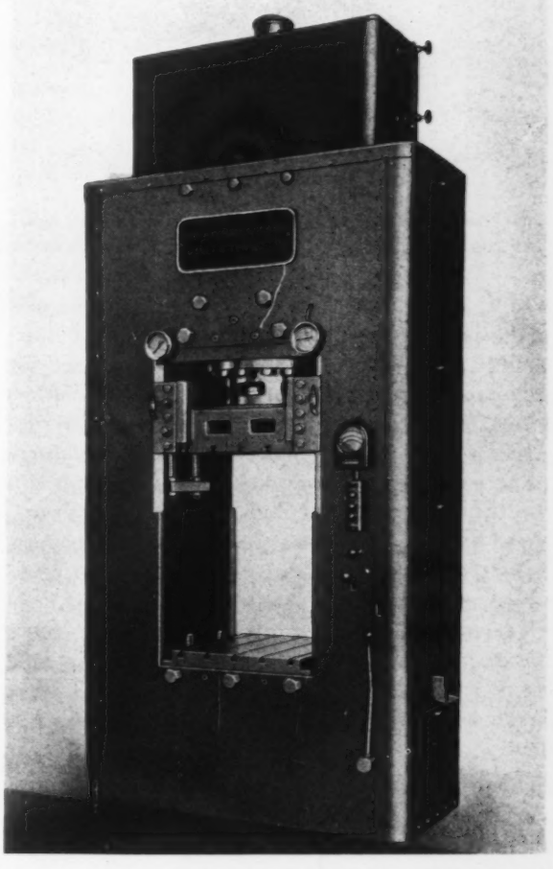


Fig. 5—A self-contained press. For small molded parts compression machines have been made automatic, for larger parts, semiautomatic

Little reference has been made to cold molding,

though many of the comments for compression molding are pertinent. There are noteworthy exceptions in that the materials are compressed cold and baked later in an oven. Mechanical molding presses rather than hydraulic molding presses are generally used in cold molding. Cold molded materials are either of the refractory type or of a bitumen-asbestos base, though phenolic materials are also cold molded in practice. Cold molded phenolics do not have the tensile strength or dimensional accuracy of hot molded phenolics, but there is a slight advantage in the unit cost of the molded article.

While a number of designs may be satisfied better by one method of molding than another, a complete understanding of the production requirements, inserts required, design tolerances, size and volume of piece, and molding equipment available will serve to emphasize the best method of molding for a particular job. It is true that there are a number of articles which can be molded just as satisfactorily by one method as another, but when one is experienced in all the methods of molding he can ascertain readily which method is suited to a particular design. For example, in the table it is observed that transfer molding is suited for designs specifying unusual and complicated inserts; pieces of large dimensions can be handled; tolerances between mold parts are good (molds are clamped together before injection of material); however, rate of production is not as rapid as by other methods. It is a good precaution, nevertheless, to consult the custom molder and ascertain the methods he proposes to follow.

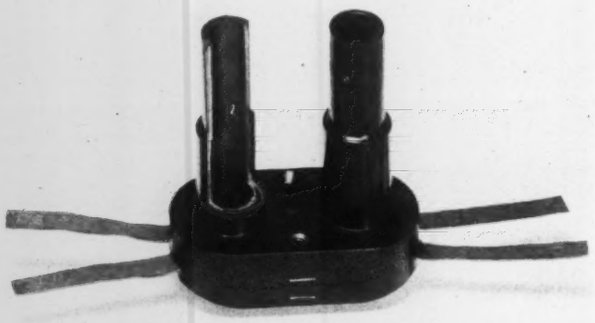


Fig. 6—Transfer and injection molding are well adapted to the molding of plastics about complicated inserts, as in this transfer-molded part

In the following paragraphs an analysis will be made of specific features of design which are influenced by the method of molding. These include materials, size, wall thickness, inserts, weld marks, etc.

MATERIAL. The specification of a certain plastic material in an engineering design will often determine the method of molding to be employed. In general, fully automatic injection molding is applicable to thermoplastic materials, such as the cellulose plastics, acrylic resins, and polystyrene. These materials are often selected for certain physical and electrical properties, as well as appearance. Should the design specify a clear, bubble-free transparent molding, the method of molding the thermoplastic material does have a bearing upon the result. Compression molding will give a clearer, more transparent article than obtained from injection methods.

From the standpoint of appearance there are other limitations characteristic of injection molding which may have some bearing upon a particular design. Reference is made to the weld marks formed when the plastic material blends together after following two circuitous paths from the injection gate. While designs of this nature are not common a definite problem exists, particularly when mottled colors are specified, because the line of demarcation at the weld point will then be even more pronounced. This problem is clarified by *Fig.* 3 which illustrates a core in a molded part, centrally disposed with respect to the entrance sprue.

Comparison of Methods and Materials Needed

Thermosetting materials such as the urea and phenolic plastics are molded by transfer or compression methods, while thermoplastic materials are injection molded. Consequently, a comparison of injection and compression molding may well entail a comparison of the different plastic materials. Comparisons between the materials will not be made in these discussions, however, having been brought out more fully in previous articles on plastics appearing in MACHINE DESIGN. It should be pointed out, nevertheless, that molding requirements of injection molding may place certain restrictions on the property value of the molded article. For example, the nature and the proportion of plasticizer content for polystyrene compositions may be such as to affect more adversely the electrical properties of an injection molded article, whereas this same piece produced by compression molding may not be as seriously affected due to smaller plasticizer content.

SIZE. One of the most significant differences between injection and compression molding, as it affects design, is the size of the molded article which can be reproduced. Injection molding machines have been designed with larger injection capacities recently, and whereas a two or four-ounce shot machine predominated a few years ago, there are some machines in operation today which have a 16 or 32-ounce capacity per cycle. In the larger injection molding machines the capacity of the shot is often too large to be handled by a single plasticizing cylinder and single nozzle in fully automatic operation, and multiple plasticizing chambers and injection nozzles are employed. These machines have permitted the injection molding of thermoplastic materials about a steel core to form automobile steering wheels, radio cabinet grilles, frames for automobile

windows, and others. Of course, as the size and volume of the design becomes larger, the number of cavities have to be reduced so that the amount of charge per cycle remains within the capacity of the machine.

Another important factor is the total projected area of the gate, sprues and cavities, insofar as the pressure developed upon the material within this area tends to react against the mold clamping pressure. While the limiting factor is the mold clamping pressure, there are other variable factors such as the plasticity of the molding material and the wall thickness of the design, which are instrumental in determining the rate at which the molding material will build up back pressure as the material is injected through the nozzle under molding pressure into the molds. Thus one material with greater plasticity will react more strongly against the mold clamping pressure than another material, for the same mold design and machine.

With respect to volume and size of the molded articles for both injection and compression molding, increased size and volume will reduce the number of cavities that can be conveniently handled in a given machine and hence this will raise the unit cost of the piece.

The size of the article produced by compression molding and the number of cavities are limited by the capacity of the molding machine, but it should be noted that there are hydraulic presses ranging in capacity up to 5000 tons. What determines the total available pressure for molding the material is the ram area in square inches and the high unit pressure received from the pump and accumulator system (which varies from 2000 to 3000 pounds per square inch). Thus for an upstroke molding press, the molding pressure may be determined as follows:

$$\text{Molding pressure in lbs. per square inch} = \frac{\text{Ram pressure in tons—dead weight of ram, table, mold}}{\text{Projected area of mold} \times \text{number of molds plus flash area}}$$

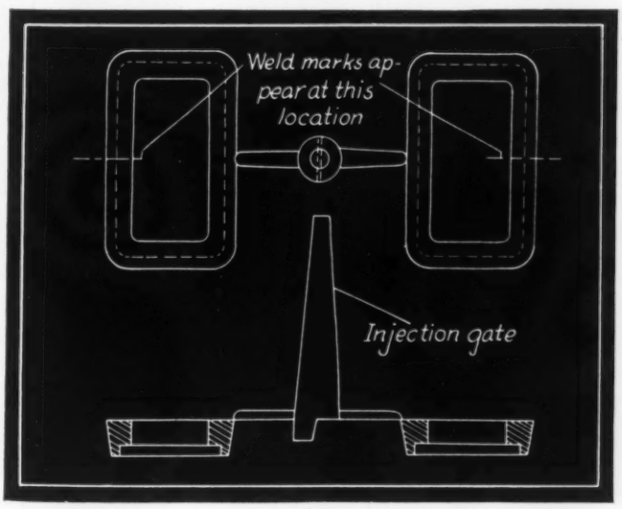


Fig. 8—Location of weld marks on an injection molded core, centrally disposed with respect to the entrance sprue, to eliminate danger to appearance

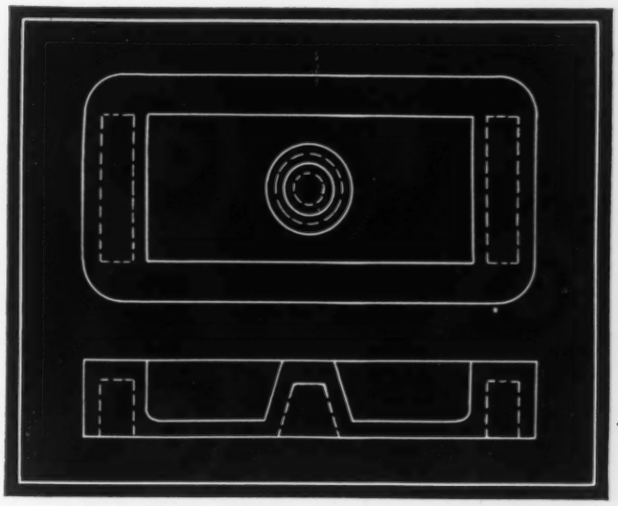


Fig. 7—Dotted lines show how design is modified to produce uniform wall thickness in an injection molded part

While custom molders are equipped with press capacities ranging from 50 to 500 tons, for a given design and a certain press capacity, the number of cavities is limited. The depth of the design and specification of some molding composition with relatively poor flowing quality will necessitate greater unit molding pressure, thus placing further restrictions upon the number of cavities that may be included. The mold design and the number of cavities to include is the specific problem of the custom molder, however, who must judge these matters from a consideration of the available press capacity in his plant.

Small and large pieces of every description are molded in compression molding. A typical large molded section, the "Cardineer," molded at Chicago Molded Products Corp., is among the largest pieces to be produced by conventional hot compression molding from an impact resisting molding material. This unit is illustrated in *Fig.* 1.

WALL THICKNESS. Another important factor in the design which is influenced by the method of molding is the wall thickness of the article to be reproduced. The thickness of injection molded sections seldom exceeds ⅛-inch with the designs produced in the present injection molding machines, one of which is shown in *Fig.* 4. This is an important fact, for if too great a wall thickness is specified the tendency toward shrink marks and incompletely filled cavities will be much enhanced. Sprues and gates of larger cross section and material with greater plasticity are possible solutions, though the former will increase finishing costs. Shrink marks upon injection molded pieces will occur if the gate and sprues solidify before the material in the mold cavities. Designs will often have to be modified to avoid them, as shrink marks not only spoil the appearance but also introduce a weak section under some conditions.

A greater latitude of wall thickness is permitted by compression and transfer molding, with no restrictions

(*Continued on Page* 74)

Scanning the Field For Ideas

BY INTERCHANGE of ideas many fields benefit through applications of devices originally developed for a specific use. No one may know the extent to which an idea or suggestion is applicable to other types of equipment. Thus this department of MACHINE DESIGN is dedicated to the advancement and extension of ideas.

Automatic control of drives to produce synchronization or other required characteristics is receiving considerable attention in current designs. Noteworthy recent developments which are typical of this trend and which hold possibilities for increased application are discussed in the following items.

Synchronizer Eliminates Beat

PROBLEMS of synchronizing associated drives on different parts of a machine or in a plant are common to many industries. In aircraft the problem resolves itself into synchronizing engines in multi-engined planes to eliminate the objectionable "beat" when engines are operating at slightly varying speeds. A difference of twenty revolutions per minute will cause a distinct beat every three seconds. Manual adjustment is tedious and often is required many times in a flight due to rough air or variations in operating conditions.

Automatic synchronization has been developed by the United Aircraft Corp. and is effected by a device consisting of a generator and differential motor mounted on each engine of an airplane. This synchronizer is schematically illustrated in *Fig.* 1. Change in speed of any engine is accomplished through adjustment of the propeller pitch on that engine, increasing or decreasing the pitch as required. This adjustment is actuated by the differential motor which is attached to the propeller control.

Operation of the differential motor occurs when the frequency of power being supplied from the gen-

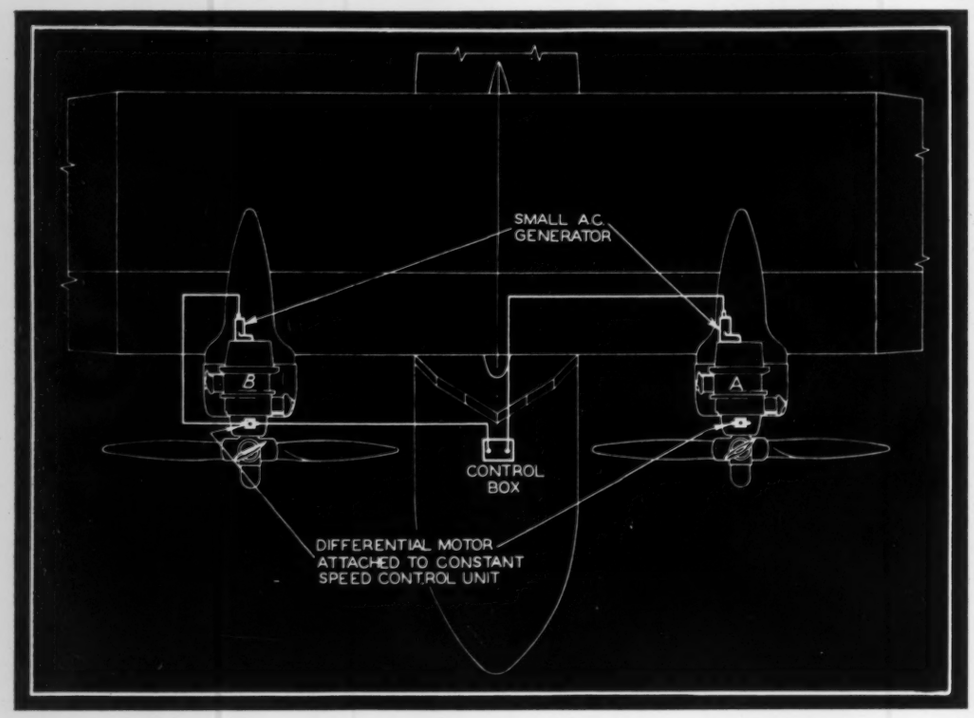


Fig. 1 — Generator on master engine *A* supplies frequency to differential motor on engine *B*. Difference in frequency with generator on *B* corrects engine speed until it is the same as *A*

erator of the master engine differs from that being supplied from its own. If the frequencies are the same the engines are in synchronism and the differential does not operate. If the speed of any engine differs by so much as one revolution per minute from

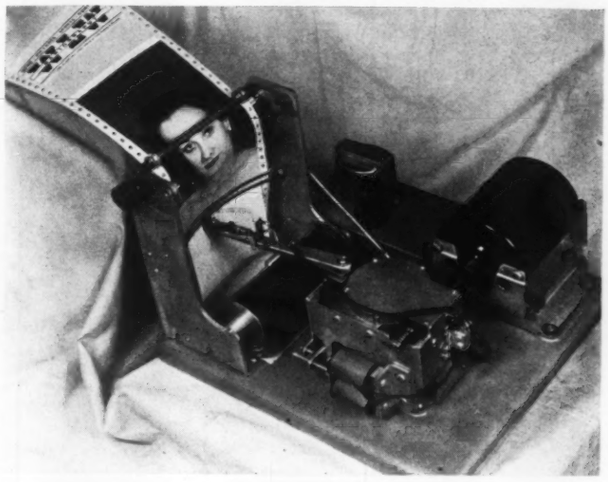


Fig. 2—Facsimile printer has clutch to start each cycle of stylus coincident with transmitter

that of the master engine, the difference in frequency causes correction.

As the motor turns it actuates a worm rack which increases or decreases the tension on a constant speed control spring. This in turn changes the pitch of the propeller, thereby changing the speed of the engine. An important characteristic of the differential motor is that its speed of rotation is directly proportional to the difference in frequencies being supplied to its two windings. Thus as an engine approaches synchronization with the master, its differential motor rotates more slowly and the change in speed of the engine becomes slower. There is therefore no tendency to "hunt" before reaching synchronization.

Cycle Impulse Prevents Distortion

SYNCHRONIZING widely remote equipment supplied by different power lines has been accomplished in a simple manner by the Crosley Corp. in their new facsimile transmitting equipment. If transmitter and receiver were to operate at slightly different speeds, serious distortion in printed copy would result.

In the printer shown in *Fig.* 2, a stylus arm is geared to oscillate two per cent faster than the scanner of the transmitter. The stylus will therefore complete one cycle in a shorter time than will the scanner and is held over at the left side by slipping a clutch between motor and arm. This clutch is then released by a small impulse of 500 cycles set up by the scanner as it starts the succeeding cycle. In this way both printer and scanner start each cycle in perfect synchronism. The slight difference in speed is constant and produces no noticeable distortion.

A geared cam actuates the reciprocating movement of the printing stylus and is coupled to a small synchronous motor through the friction clutch which consists of two rotary ground plates with a thin cork disk between them. Two small coils on the left side of the printer operate a small pawl to release the clutch.

Absorbs Shock from Drive

WITH no mechanical connection between driving and driven sides of flexible magnetic couplings, power is transmitted from rotor to frame through the air gap. These couplings may be likened to induction motors except that both parts turn in the same direction at substantially the same speed. Mechanical rotation of the driving part causes rotation of its field which in turn induces a similar movement of the driven part. Practically no shock is transmitted through the couplings. They absorb vibration, compensate for misalignment and equalize the load between the twin diesels and reduction gear driving a ship propeller. This application, designed by the Elliott Co., is shown diagrammatically in *Fig.* 3.

Transmitted torque varies with the difference in speed of the coupling members. Designs may have pull-out torques for values between 125 and 250 per cent of full load. Torque increases with the slip to its maximum. At loads beyond that, the coupling pulls out of step and the torque falls rapidly as the slip increases. When slip reaches 100 per cent or standstill, the torque is thirty-five per cent. This characteristic is desirable because diesels cannot in

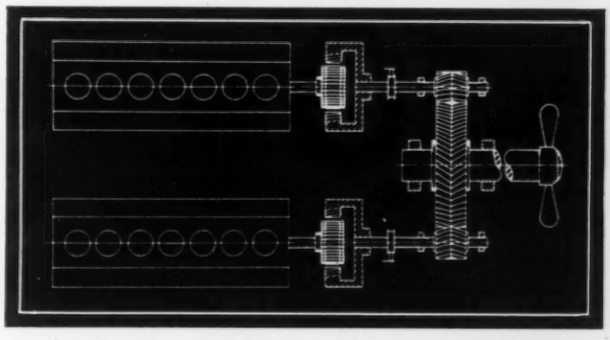


Fig. 3—Diagram of electromagnetic slip couplings between twin diesels and reduction gear

general exert torques appreciably greater than full-load value. In this way the coupling releases the engines of heavy overloads by automatically reducing their transmitted torque and protecting the drive against damage.

Other applications might include any system where it is desirable to eliminate the periods of vibration of diesels which otherwise would have to be considered in design.

Which Motor Fits the Job?*

By W. R. Ridgway
Ingersoll Milling Machine Co.

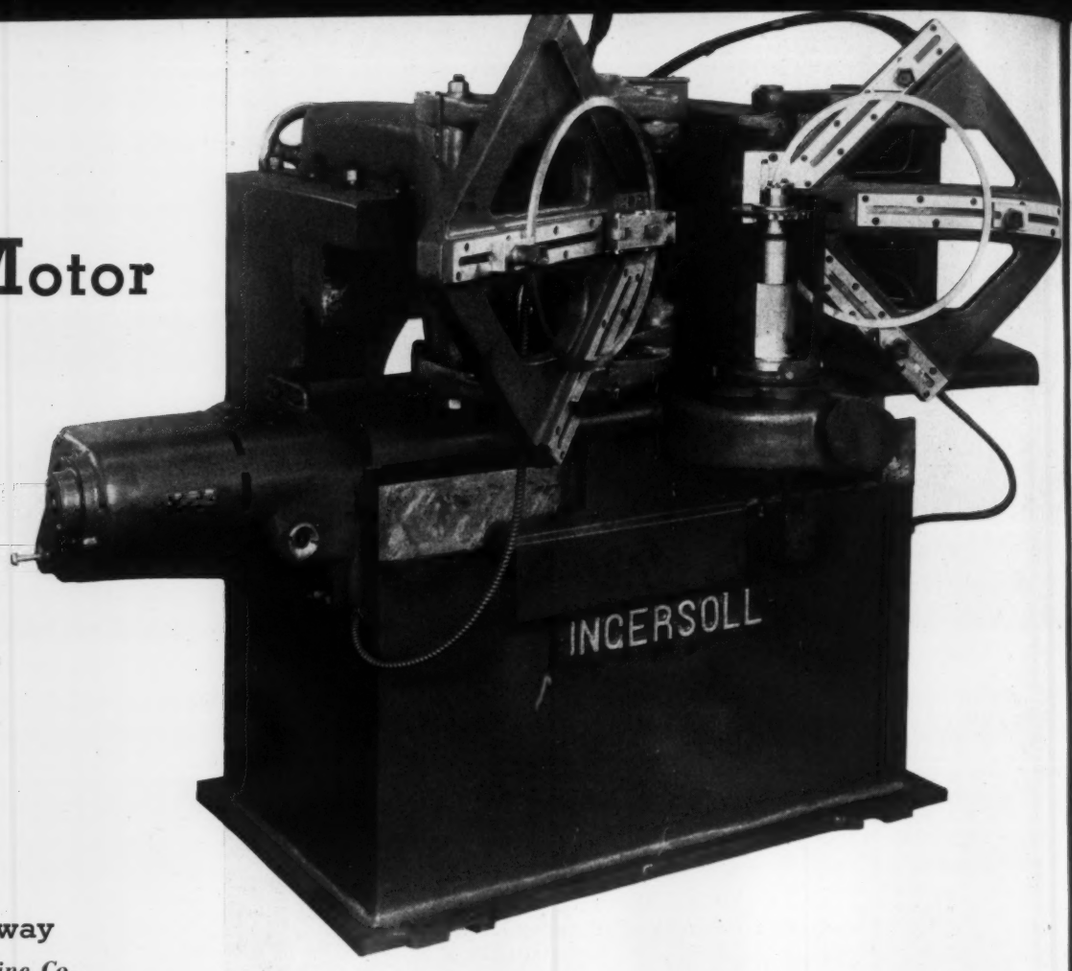


Fig. 1—When load requirements are known, selection of drive is readily determined such as for the machine shown for slotting piston rings

TO FACILITATE motor selection for machines, an empirical method has proved effective and adequate for applications not involving extremely unusual operations. Through its use, considerable time is saved compared with conventional methods of applying each motor to a specific set of conditions.

This method is based on the theory that once the function of the various characteristics of motors is clearly defined, the selection can be made quickly. An automatic means is included for rejecting unusual operations which always require a comprehensive analysis. It also includes a number of arbitrary figures and statements which may have to be modified to suit individual problems.

Assuming that the choice of motors for machines such as those in *Figs.* 1 and 3 is restricted to the available power supply, the first step is to select the proper type of enclosure. That will affect the power rating and mechanical modifications required. Enclosures to consider are: Open, semienclosed, enclosed, drip proof, fan cooled, etc.

Operating conditions and duty cycle, together with initial costs, largely determine the enclosure needed. To give comparative figures on selection with respect to cost, Table I shows prices of various constructions for a 20-horsepower, 1200 r.p.m., continuously rated motor with ball bearings. Semienclosed and drip-proof frames are modifications of direct-current motors and are therefore not shown with the alternating-current motors.

The next step in motor selection is to determine the torque characteristics required. Those commonly used are normal, high and low starting torque, and the high slip type for alternating current; also shunt, compound and series wound for direct current. Special characteristics are available for applications not covered by these types such as for rapid, cushioned reversing, for exerting continuous stalled torque, etc., but this discussion will be confined to the more usual equipment. Alternating-current motor

TABLE I

Comparative Costs of 20-Horsepower Motor

Construction	A. C. Price	A. C. % Over Open	D. C. Price	D. C. % Over Open
Open	$227	0	$522	0
Semienclosed	...	..	540	3
Drip-proof	...	..	540	3
Drip-proof, fully protected	...	..	558	7
Splash-proof	251	10	576	10
Totally enclosed, fan-cooled	320	41	787	51

* *Presented at Westinghouse Machine Tool Electrification Forum.*

characteristics are shown in *Fig.* 2.

Motors with normal starting torque for direct current, shunt wound, are best suited for general purpose applications on drives in which the speed must not vary appreciably with fluctuations in the load, where the highest torque must be delivered near full speed and where the machine inertia is neither an inherent factor in the machining process nor a considerable factor in starting from rest.

Alternating-current motors with normal starting torque are available in two types, normal starting current and low starting current. The curves show that the normal starting current motor loses less speed as the load increases, has a higher maximum torque. This type has further advantages of higher efficiency, higher power factor and usually lower cost. These advantages are offset by having a starting current about seven times full load current, compared with five for the low starting current motor. Normal starting current motors may be used for all applications requiring 5 horsepower and less, also

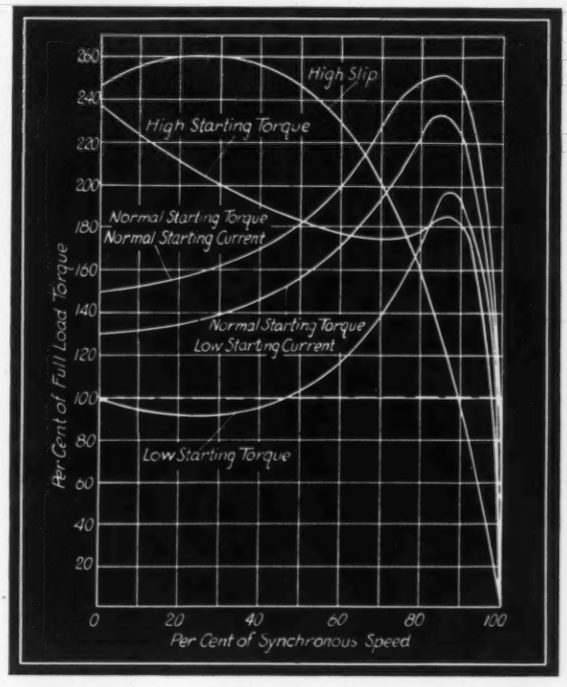


Fig. 2—Comparison of characteristics of squirrel-cage induction motors showing speed-torque curves

for applications requiring from 7½ to 50 horsepower, which are not to be inched or restarted for each successive machine cycle.

Low starting current characteristics should be used for alternating-current motors from 7½ to 50 horsepower which are to be inched or restarted for successive machine cycles. Such motors should be used with full voltage starting unless the power supply will not permit. Above 50 horsepower, each application should be analyzed to determine the most effective combination of a normal or low starting current motor, full voltage or reduced voltage starting, and magnetic or manual control.

High starting torque alternating-current motors, or compound wound direct-current motors, are applicable where maximum torque is required at starting, where speed variations with fluctuating load are relatively unimportant and where continuous operation at full speed is not required. An example of this would be a rapid traverse motor directly connected to the machine gearing.

How To Determine Rating

Low starting torque alternating-current motors having the same characteristics as direct-current, shunt-wound, with high starting resistance, can be used for machine tool drives in which the speed must not vary appreciably with variations in load, where the highest torque must be delivered near full speed and where the machine design places an inherent limitation on the torque during acceleration to full speed. An example of this would be a band saw or a grinding wheel spindle in which belt slippage or blade breakage would result from accelerating too rapidly.

High slip alternating-current motors should be applied to machines in which parts having high inertia are intended to release their energy to perform an operation. Typical of this application would be a punch press in which a heavy flywheel furnishes the actual power for forming the metal while the motor merely tends to keep the flywheel running at a constant speed. The high slip characteristics act as a cushion between the machine and the line, and absorb the high peak load which would result from the application of a motor that tried desperately to maintain a constant speed. In that case the motor would be supplying an appreciable amount of the energy for forming the metal and the flywheel would not be doing its job.

The point has now been reached at which the

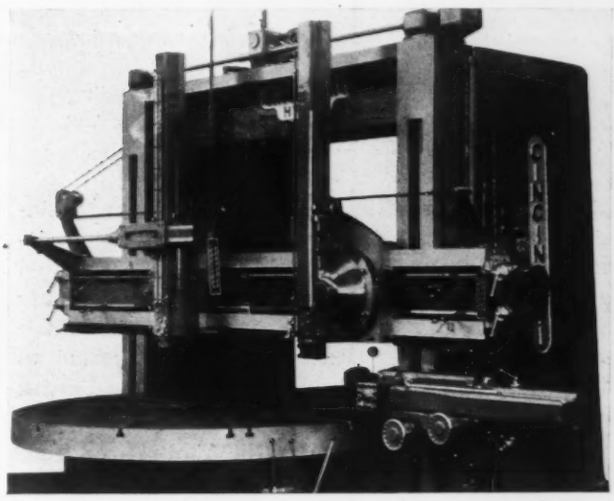


Fig. 3—Machine for milling heavy parts. Drive is selected on continuous duty basis

horsepower rating can be selected. When the exact nature and magnitude of the load are unknown and not determined, power selection must be made on the basis of judgment with attention to the fact that only an open continuously-rated motor with unrestricted ventilation can be expected to deliver up to 115 per cent of its rated capacity continuously and that the approximate maximum torques and horsepower of motors, deliverable momentarily, are as shown in Table II.

TABLE II

Approximate Maximum Capacity of Motors Deliverable Momentarily

	Torque %	H.P. %
Alternating-Current:		
Normal starting torque, normal start. current	250	180
Normal starting torque, low start. current	230	165
Low starting torque	190	150
High starting torque	240	130
High slip	260	115
Direct-Current:		
Constant speed, shunt wound	200	200
Shunt, adj. speed, above twice base speed	150	130
Compound wound	300	200

If the exact nature and magnitude of the load are known, the selection can be made on a rational basis. After plotting the load curve, similar to that shown in *Fig.* 4, which the motor will be expected to deliver, the horsepower can be calculated on a root-mean-square basis and a rating chosen which is the next higher standard rating above the figure for the root-mean-square horsepower.

Root-mean-square horsepower is calculated for a period extending from the beginning of one cycle to the beginning of the next (excluding all standstill time) by the following formula.

$$RMS = \sqrt{\frac{H_1^2 T_1 + H_2^2 T_2 + H_3^2 T_3 + \ldots}{T}}$$

where

H_1 is the power required during the period of seconds T_1

H_2 is the power required during the period of seconds T_2, etc.

T is the total time of one cycle, not including standstill time, but including the time the motor is running idle.

Calculations must be based on maximum maintained load for the longest period and with the shortest light or idle periods possible to obtain. It should be noted that totally enclosed, fan-cooled, and totally enclosed, nonventilated motors, when selected on the root-mean-square basis, should not be expected to carry 150 per cent load for more than 40 consecutive seconds.

The choice of a motor on the root-mean-square basis assures that the motor will not overheat. It is also necessary to consider the maximum horsepower which must be delivered because it is possible to have cycles with high peaks and broad valleys which would mean the selection of a motor on the root-mean-square basis which would not overheat, but neither would it have the capacity to deliver the power required at the peak; thus it is necessary to check the application of the motor on the basis of the maximum horsepower. This can be done by using one of the factors shown in Table III. The maximum load required multiplied by this factor gives required rating of motor.

TABLE III

Maximum Horsepower Factors

	Revs. per minute Over 900	Under 900
Alternating-Current:		
Normal starting torque, normal starting current	0.66	0.72
Normal starting torque, low starting current	0.72	0.78
High starting torque	0.91	1.00
Low starting torque	0.79	0.86
High slip	1.00	1.00
Direct-Current:		
Constant speed, shunt or compound	0.60	0.60
Adjustable speed	0.75	0.75

When a repetitive machine cycle requires an alternating-current motor with a total of more than four starts, plug stops, plug reversals, or speed changes per minute, the application should be checked with the motor manufacturer.

This completes the application of the horsepower rating from which the time rating may be chosen. A continuous rating is required where the ratio of the root-mean-square horsepower to the actual horsepower rating selected is greater than .70. If less than this figure a short-time rating may be used.

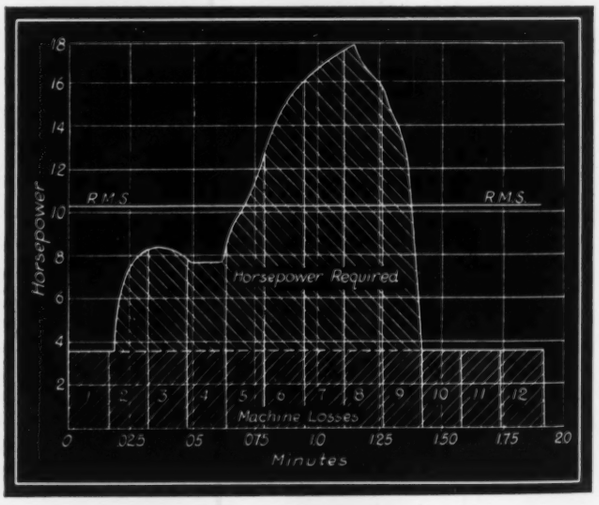


Fig. 4—Typical load curve for which the root-mean-square method provides adequate rating

If this rating is applicable and the ratio of "time on" to "time off" is less than 1:4 and also if the motor cannot be operated uninterruptedly more than 15 minutes out of each 75, a ¼-hour rating can be

(*Concluded on Page* 81)

Selecting Seals and Packings

By
George Z. Griswold

Part III
Flexible Metal Seals

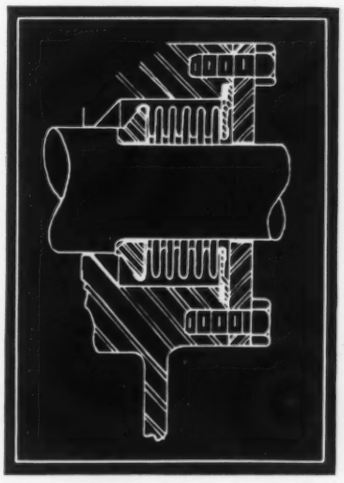


Fig. 1—Typical application of a bellows seal, used for unusually severe operating conditions

BECAUSE flexible metal seals are utilized where severe operating conditions make an absolute seal mandatory, they will be discussed in the third article of this series, following unit seals and packings. One of the most widely used form of flexible metal seals is the bellows type; another is the diaphragm seal.

A fine example of the latter type was shown on page 25 of the March issue of MACHINE DESIGN in the cutaway picture of the reel for spinning rayon by the continuous process. Here the diaphragm effectively protects all bearings on the reel from the various process solutions which flow over the rayon as it moves on the reels. The seal, moreover, is flexible enough to permit it to adjust itself with the motion of the skewed eccentric of the reel. Most of the illustrations shown in the current article, however, will be those employing bellows seals.

The bellows type seal finds its special niche in ap-

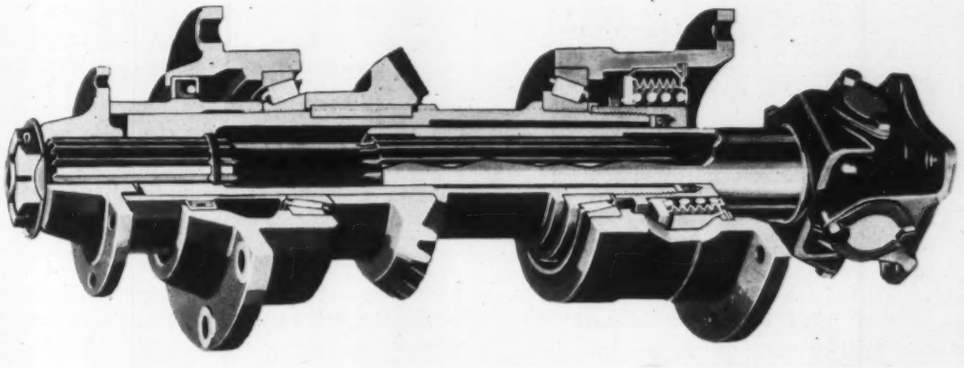


Fig. 2—Cross-sectional view of a main slip shaft for buses, where seal must be absolute

plications where temperatures and pressures are high, operating conditions unusually severe, and an absolute sealing effect is imperative. Consequently it is frequently employed in machinery where gas or liquids are present, such as refrigerating equipment, fuel pumps, vacuum pumps, pressure regulators, shock absorbers for airplanes, recording instruments, and the like.

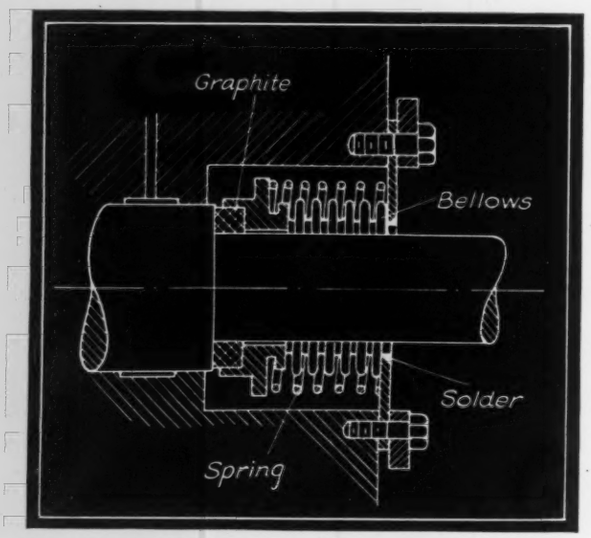
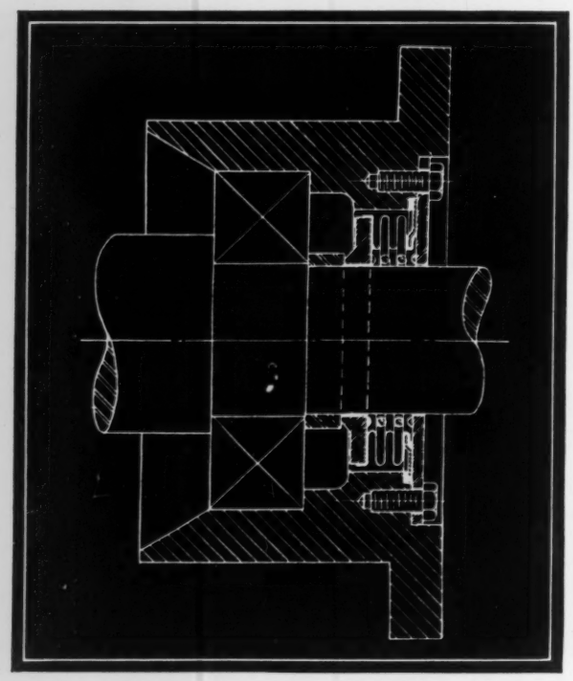


Fig. 3—A spring touching the seal nose and the retainer is here used to prevent bellows contraction

Fig. 4—Below—Seal assembly for a speed reducer, showing important role seal rings may play



Brass has long been the standard material for bellows seals, but higher pressures and demand for greater tensile strength, greater corrosion and heat resistance have brought about considerable use of stainless steel and monel. Obviously where acids are encountered brass should not be employed. Usually ordinary soft solder is used to attach the bellows to end fittings, but one interesting development involves a method of welding stainless bellows by the electric resistance method to the stainless end pieces.

A typical application of a bellows seal is shown in *Fig.* 1, where the inner diameter of the shaft is ¾-inch, the outer diameter of the seal 1⅜ inches. *Fig.* 2 is a cross-sectional view of a main slip shaft for buses, which illustrates the increasing use of this type seal in the automotive industry. The seal for the output shaft of a similar transmission requires a seal of this type because the shaft is so submerged in oil that any loosening of the seal would result in serious loss of oil. Not only is such a loss harmful to the mechanism but in some cases it has permitted grease and oil to escape to roads and pavements to the extent that different municipalities are legislating to provide penalties.

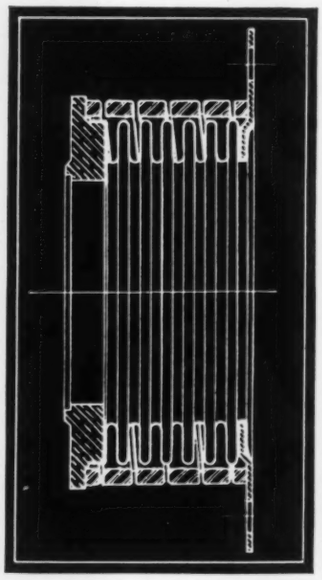


Fig. 5 — A flat spring, pressed tightly against the seal ring, is used on this compressor seal assembly

A copper bellows seal in a well-known tractor, where dirt of all kinds must be kept from the final drive and oil must be sealed in, is located at each end of the sprocket hub. It bears against smooth washers fitted on each side of the track sprocket. Oil inside the bellows lubricates the rubbing surfaces. The seals are self-adjusting to all kinds of deflections. So effective is this method of sealing that it has been found necessary to vent the gearcases of the final drives as the temperature changes, to take care of expansion and contraction of the air within. Under operating conditions it is necessary to change the oil only at 900-hour intervals.

Fig. 3, another typical application, differs from *Fig.* 1 in that a spring is used to keep the bellows from contracting unduly. The seal ring immediately to the left of the bellows in *Fig.* 4, a seal assembly for a speed reducer, is of interest because of the important

role seal rings may be made to play in connection with the application of bellows. The seal ring here has an inner diameter slightly more than that of the shaft. Frequently, however, when it is desired to install a bellows seal so that it will hold pressure either inside or outside of the seal as the occasion requires, the size of the seal ring nose is changed or balanced to conform with the mean diameter of the bellows. The spring in *Fig.* 4 is inside the seal. On a heavy duty compressor in *Fig.* 5 a flat spring, pressed tightly against the ring, is used.

Mention was made earlier that ordinary soft solder may be used to fasten the joints between the bellows and the seal nose and between the bellows and the retainer on the other end. One of the latest methods of effecting this joint is through welding by the electric resistance method, but in one automotive application and numerous similar instances, where temperatures are too high for soft solder, silver solder is still employed.

Welding has been combined with a bellows in another way in an expansion joint for pipe lines. Difficulties encountered include thermal expansion, pressure, vibration, temperature changes—and service attention is decidedly undesirable. The joint has forged steel flanges which are welded and sealed to the stainless steel bellows by means of heavy reinforcing rings. An internal sleeve, a free sliding fit within the flanges, guides and limits their movement, the flanges being counterbored to provide shoulders to engage the limit stops at full extension.

Bellows seals are made with inside diameters ranging from ¼-inch to approximately 8 inches, with outer diameters as high as 12 inches. Inner diameter of the seal for an outboard motor shaft in *Fig.* 6, for

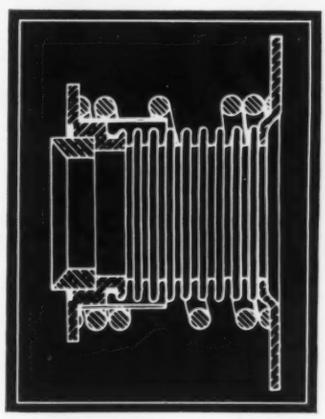


Fig. 6—Inner diameter of this outboard motor seal is less than three-quarters of an inch. Lower limit is one-quarter-inch

instance, is only 23/32-inch; that in *Fig.* 5 is 2-11/16-inches. *Fig.* 7, the seal on a water pump, is unusual because of the small number of convolutions and the relative thickness of the metal in the seal. An ingenious method of fastening the ends of the bellows has been employed.

Co-operation of the following companies in the assembly of information and illustrations for this article is acknowledged: Alloy Bellows Engineering Co. (*Figs.* 4, 5 and 6); Chicago Metal Hose Corp. (*Fig.* 3); Fulton Sylphon Co. (*Figs.* 1 and 7). Clifford Mfg. Co., Spicer Mfg. Corp., and Twin Coach Co. collaborated on information and the photograph for *Fig.* 2.

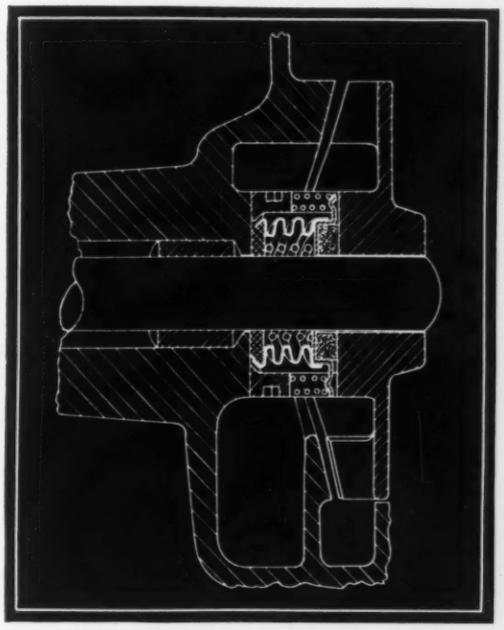


Fig. 7—An ingenious method of fastening ends has been employed on this water pump seal

Polarization of Light Used in Photoelasticity

TO MAKE analyses of three-dimensional stress systems, Royal Weller, department of physics, Ohio State university, uses the polarization caused by the scattering of light within a cloudy plastic model instead of the usual analyzer in photoelastic investigations. A model is made from a suitable transparent plastic containing enough scattering particles to analyze satisfactorily a beam of polarized light, and the model is then loaded and placed in a beam of plane-polarized light which has been collimated and passed through a slit. A plane section through the model is then illuminated. Interference fringes appear in this section when it is viewed normal to the direction of the beam and also to the plane of polarization of the beam. All possible sections may be observed by placing the model in any desired position with respect to the beam. The model may be immersed in a liquid of the same index, if desired, to eliminate unwanted refraction.

Advantages claimed for this method are numerous. It is possible to search for the directions of the maximum and minimum shears at any desired point by illuminating successive planes and observing the fringe patterns in them. Maximum and minimum shears at any interior point may be determined and the principal stresses at a free edge may be separated with ease. The model need not be heated.

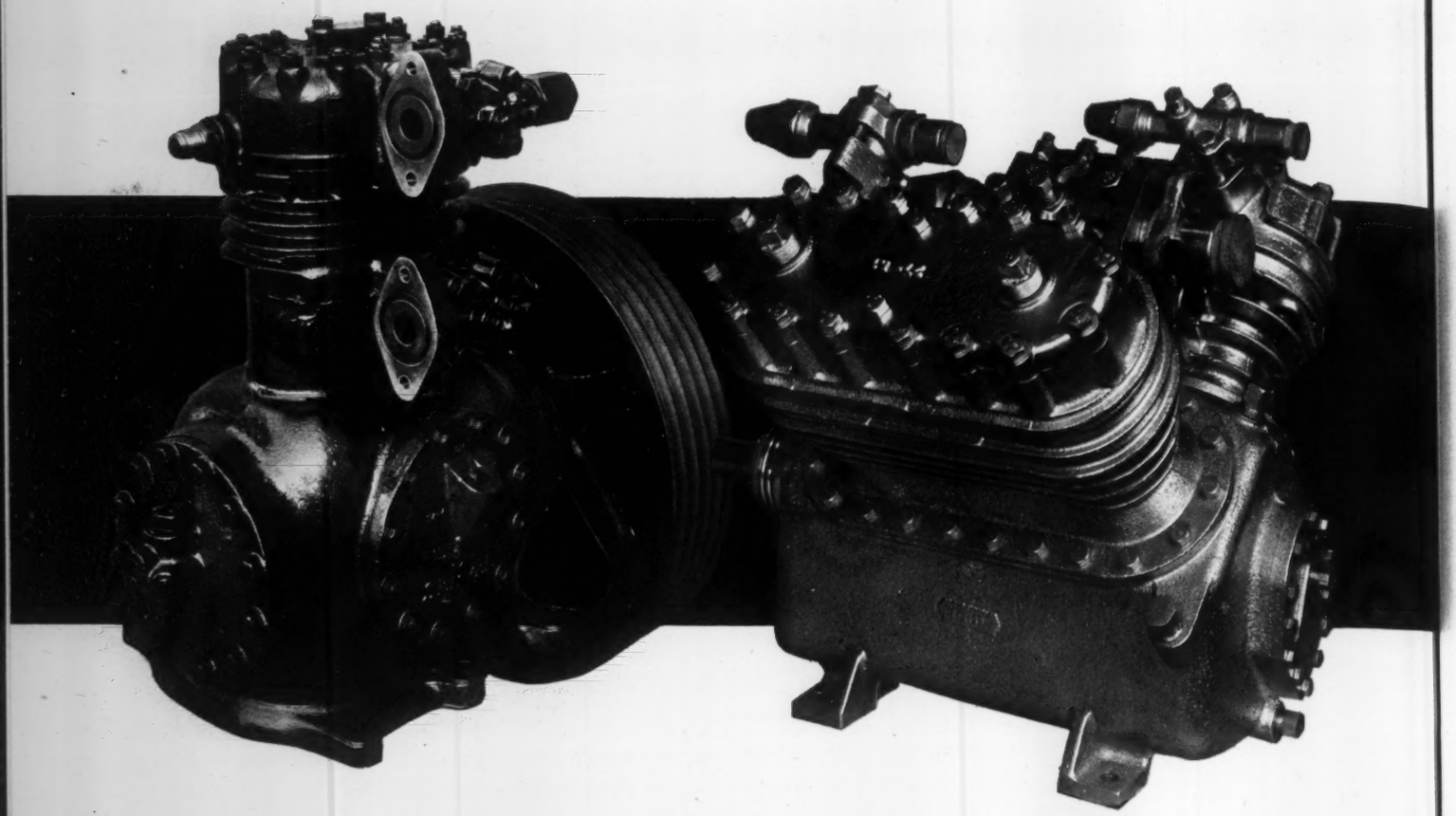


Fig. 1—Former and redesigned models of ten-ton compressor unit. Older units were twice the height of the new ones

Redesign Eliminates Noise and Vibration

By W. J. Aulsebrook

Servel Inc.

AIR conditioning and other installations requiring refrigerator compressors have necessitated refinements in design to permit increased capacities, unit assemblies and compact design for office, store and home. Prime among their requirements is the reduction of noise and vibration which otherwise would be a source of discomfort and require extreme isolation methods. Also, higher operating speeds, reducing size and increasing capacity, involve refinements as discussed in this article.

Questions of bulk, noise, vibration or overall efficiency attracted little attention in the early designs of refrigerating machines. Even the crudest equipment had advantages over previous methods and because installations usually were made in basements, a reasonable amount of noise and vibration was a negligible factor. In general manufacturers produced low-speed single or twin-cylinder units which differed from early industrial units only by variations in displacement and condenser size.

Single or twin-cylinder compressors of conventional design offered obstacles to the accomplishment of the standards which were increasingly demanded as air conditioning became more popular. Consequently, all

sizes of compressors from ¼ horsepower to 40 horsepower were redesigned with the object of developing compact equipment which could be housed in air conditioners, self-contained fixtures, etc. and which would operate at a noise and vibration level acceptable in the field. A comparison of old and redesigned ten-ton units is shown in *Fig.* 1.

Noise in earlier equipment when analyzed, proved to be almost entirely traceable to clicking or knocking sounds caused by the lifting and reseating of valves, complicated by pin and bearing knocks which were in evidence if not exactly fitted or after use had developed a small amount of wear. Other intermittent noises were traceable to excessive volumes of oil passing through the compressor with the refrigerant. All of these noises except the last could be reduced or eliminated only by reducing the size and weight of valve parts, pistons, rods and other reciprocating members. The obvious method to accomplish this result was pursued, namely, to substitute four or more small cylinders for the two larger ones and to design the equipment so that it might be operated at materially higher speeds.

Lower Velocities Result

New models distribute the frequency of compression from 2300 per minute on the slowest four-cylinder unit to 9500 per minute on the highest speed eight-cylinder model, as compared with an average of about 1000 compressions per minute on previous conventional models. Interesting also is the fact that whereas the revolutions per minute averages more than double that of the older models, the piston velocities and consequently the wear factors are substantially lower. Likewise smaller crankshafts are used because torque requirements are lower. In most models this results in a lower peripheral speed.

An additional advantage that the multiple-cylinder compressors possess is that a much simpler problem of mechanical balance presents itself through the use of counterweights and opposing equivalent parts. The area and weight of valve elements, pistons, etc. have been drastically reduced and the natural frequency of the remaining vibration is at a much higher level. Sympathetic vibration of the base, condenser and accompanying parts is almost wholly eliminated. The comparisons in Table I contrast several size brackets.

The second source of "noise" traceable to clearances on pins, bearings and similar parts, could be reduced only by closer tolerances and the substitution of wear-resistant materials to preclude noise as the equipment aged. This was accomplished by new tooling, such as precision broaching and diamond boring of cylinders, as contrasted with the previous drill-ream-hone procedure; by diamond boring main bearings, eccentric straps, pin bushings, etc. to close limits, and by the use of precision fixtures to insure positive alignment of the various integral parts in final assembly.

In addition, all air-conditioning units of two tons and larger sizes are equipped with steel-backed, copper-lead precision bearings, bushings and sleeves running on casehardened or quench-hardened forgings and force-lubricated by means of a pump on the end of the eccentric shaft.

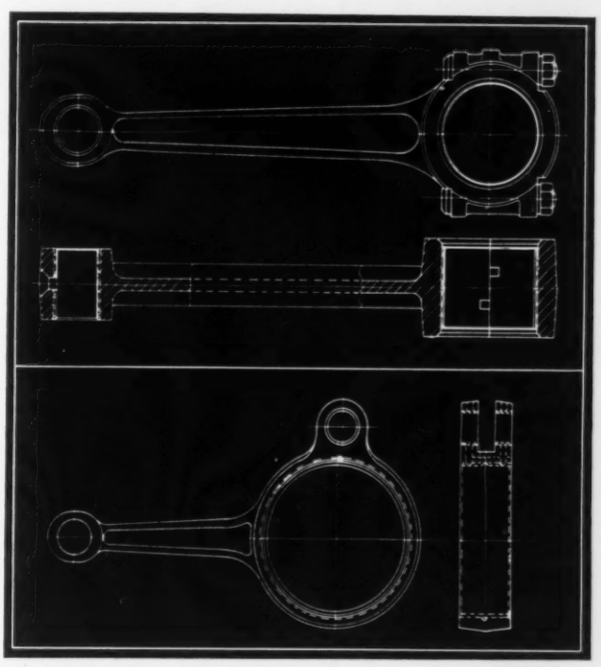


Fig. 4—Drawings of old and new connecting rods. Cam-type rod used on new unit is shown at bottom and illustrates reduction in mass achieved

Substitution of eccentrics for conventional connecting rod and crankshaft type of construction was based on experience over a long period. It had been found

TABLE I

Comparisons Between Old and New Models

	New Model					Old Model				
Tons	Cylinders	Bore (inches)	Stroke (inches)	Speed (r.p.m.)	Piston vel. (f.p.m.)	Cylinders	Bore (inches)	Stroke (inches)	Speed (r.p.m.)	Piston vel. (f.p.m.)
1	4	1⅝	1⅜	585	136	2	2⅛	2	465	155
3	4	1¾	1¾	920	268	2	2⅛	2 13/16	690	320
7½	8	2⅛	1¾	920	268	2	3¾	3¾	530	332
10	8	2⅛	1¾	1180	344	2	3¾	3¾	690	430

that the much larger bearing areas greatly reduce the distortion of both parts due to shock loads which are inevitably encountered in refrigeration compressors when maladjustment or abnormal conditions cause the return of large quantities of liquid refrigerant or oil from the evaporator. Designs of the old and new crankshafts are shown in the drawings in *Fig.* 2. The old problem of flattened crankshafts and egg-shaped bearings has no counterpart in a well-designed eccentric type unit, although it is to be admitted that the wear factor under simple gas pumping conditions should be very little different in either case.

Eliminates Hydraulic Slap

Improvements in the suction valves shown in *Fig.* 3 are indicative of the extent of redesign. The earlier models used two 3-inch diameter valve disks backed with relatively heavy spring and retainer. New models use eight 1¾-inch diameter flexible disks. Likewise, the discharge valves illustrated in *Fig.* 4 show the reduction in size effected. Former compressors used two 3-inch disks whereas the new design employs twenty-four thin disks approximately ¾-inch in diameter.

The third factor contributing to noise and vibration is not strictly a mechanical one, but is peculiar to refrigerating machines and particularly those using oil-miscible refrigerants, such as methyl chloride and Freon. This is the factor of hydraulic slap, caused by the pumping of liquid (either oil or refrigerant). An efficient refrigerant compressor must approach as closely as possible to zero clearance volume at the end of its stroke, as contrasted with internal combustion equipment which finishes its stroke with a relatively high volume of gas over the top of the piston. The presence of any considerable volume of incompressible liquid in the cylinder, therefore, results in a sharp hydraulic blow at the top of the piston stroke, which not only causes noise and rocks the assembly physically but in extreme cases may cause severe distortion and even breakage of valves, rods and other parts.

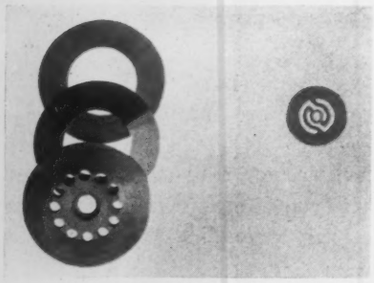


Fig. 3—Comparative sizes of disks for suction valves. New disk is shown at right of old ones

Lubricating oil from the crankcase of course sprays or splashes to lubricate cylinder walls and pistons and, as in all devices of this sort, a certain amount of oil is scrubbed past the pistons. If sudden changes in crankcase pressure occur the inevitable mixture of refrigerant and oil in the case effervesces or boils violently, with the result that some oil may be forced back into the suction port and enter the compression area with the suction gas.

To minimize this effect the crankcase is substantially sealed from the suction chamber and is vented into this chamber by a relatively small opening drilled in the casting. This serves to "bleed" out the refrigerant from the crankcase at a relatively slow rate and to prevent sudden drops in pressure which cause effervescence or boiling of the oil-refrigerant mixture in the case. The small amount of oil which is scrubbed past the pistons in serving their normal lubrication requirements returns to the suction port with the gas and impinging against baffles is dropped into a sump chamber from which it finds its way into the case through a check valve. This return of oil is intermittent, being predicated on the equalization of crankcase pressure and the small but regular fluctuation of suction pressure due to the action of the expansion valve in the evaporator of the system.

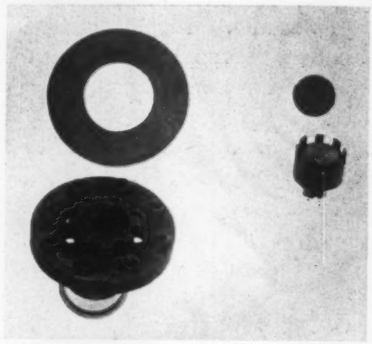


Fig. 4— Earlier model used three-inch disk for discharge valves as shown at left, New model uses thinner disks of three-quarter inch diameter

Manufacturing Costs Balance

This construction has removed the problem of noise and vibration from oil slugging, but there remained the inevitable possibility that through maladjustment of the expansion valve or float on the evaporator, or through accumulation of liquid in the evaporator during shut-down periods, excessive volumes of liquid refrigerant might be returned to the compressor without warning. The unfavorable effects from this action have been eliminated by designing the chambers and passages leading to the cylinders in such a way as to "starve" the compressor under these conditions. In other words, it is physically impossible for any considerable amount of liquid to enter the cylinders through the normal gas ports during operation. When these "slugs" of liquid are returned they are assimilated slowly and pass through the compressor without hydraulic hammering effects. Considerable ingenuity was required to accomplish a design of

(*Concluded on Page* 81)

By
George R. Martins
Falk Corp.

Drafting Room Practice*

RESPONSIBILITIES of the design and drafting divisions of the engineering department are so interrelated that it would be difficult to draw a sharp line of distinction between their respective activities. Much of the preliminary work leading to a finished design must of necessity take place on the drawing board. However, certain essential data in the form of sketches and specifications, for instance, prepared by the engineers, are necessary before any drafting work is begun. Thus, to be efficient, manufacturing organizations must provide for the maximum of co-ordination between the two divisions.

Maintaining technical and theoretical activities in close proximity with the drafting personnel has been found advantageous at the Falk Corp. Draftsmen confer with research, development and application engineers on any specific question which may arise.

In addition to the regular sections for inquiry, order analysis and special and standard orders, a development group is maintained for all preliminary work. Before actual design of new equipment can be undertaken, its market potential must be determined. Then its suitability for competing in its field is analyzed. This requires a series of preliminary studies including drawings, technical determinations, cost and indicated selling price. With this basis the management is able to determine whether or not to proceed with development.

If the decision is favorable, further studies are conducted to determine the most economical design. This involves a rigorous treatment generally confined to a single unit of the proposed series. The results are applicable to the complete line. Many determinations are theoretical as, for instance, computations relating to graduation of units, capacities, strengths and durability of component elements. These are handled by a technical group under direction of the development engineers. Development drafting functions are directed by a supervisor who is thoroughly familiar with standardization procedure so that the salient items affecting design and manufacture can be taken into consideration.

Test Results Applied

Once each week the chief engineer meets with the development engineer and supervisor to discuss current problems, review progress, and plan the program of future activity. A chart is kept showing the time and personnel consumed on each project. The required research and test laboratory activities neces-

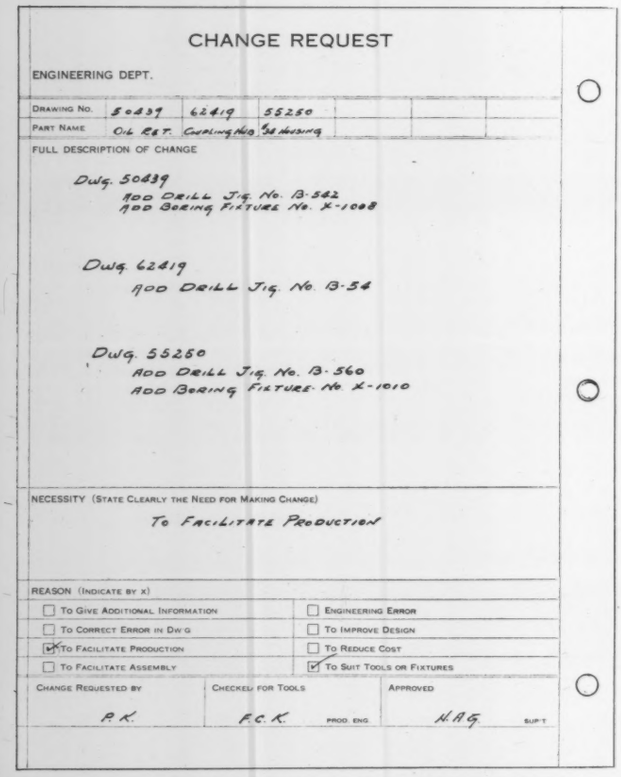
* *From a paper presented before the American Gear Manufacturers' Ass'n.*

sary to perfect the sample units are set down in a systematic test schedule whenever possible. Close contact is kept on all laboratory investigations so that test results can be applied during the embryo period. After units have been installed, actual performance in the field is checked with the service department so that steps can be taken to correct any weakness which might develop.

The work of the research group can be divided into the following main divisions: Theoretical analysis, test laboratory operations and metallurgical studies. These duties include basic studies of new ideas, inventions, and the like. Drawings required for research activities are generally prepared within the group. Wherever possible, sketches are used. This has been found practical for experimental purposes. It has the advantage not only of lower costs, but permits a little latitude for expression of originality on the part of the laboratory mechanics.

All Changes Are Recorded

The record section acts as a service bureau for the entire drafting department. A record clerk fills out print order forms as tracings are submitted for issue, noting issue and re-issue dates on numerical record cards. He furnishes drawing numbers for completed drawings, issues pattern numbers, records all changes which may originate from the drafting sections, issues numbers for all new bills of material, and records general description on all new jobs. These



CHANGE REQUEST

ENGINEERING DEPT.

DRAWING NO.	50439	62419	55250			
PART NAME	OIL RET.	COUPLING HUB	#34 HOUSING			

FULL DESCRIPTION OF CHANGE

Dwg. 50439
ADD DRILL JIG. NO. B-542
ADD BORING FIXTURE NO. X-1008

Dwg. 62419
ADD DRILL JIG. NO. B-54

Dwg. 55250
ADD DRILL JIG. NO. B-560
ADD BORING FIXTURE NO. X-1010

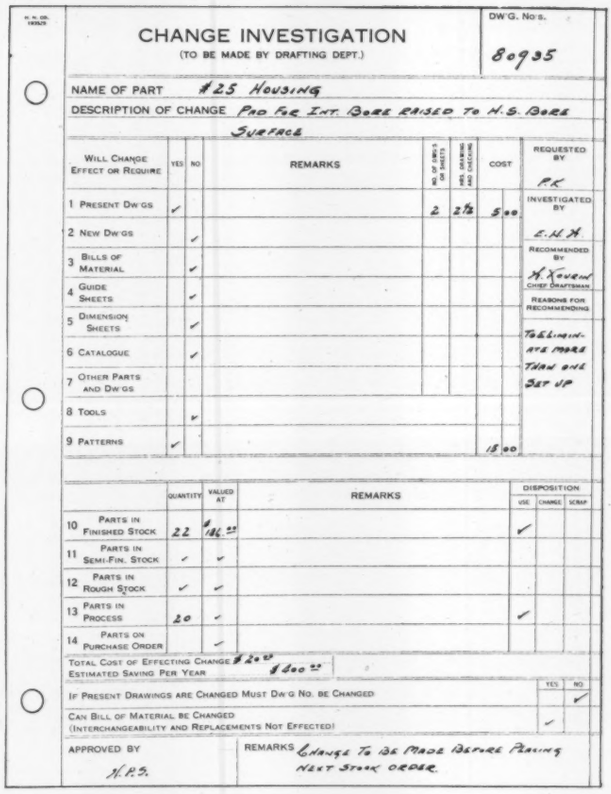
NECESSITY (STATE CLEARLY THE NEED FOR MAKING CHANGE)
TO FACILITATE PRODUCTION

REASON (INDICATE BY X)

- [ ] TO GIVE ADDITIONAL INFORMATION
- [ ] TO CORRECT ERROR IN DWG
- [x] TO FACILITATE PRODUCTION
- [ ] TO FACILITATE ASSEMBLY
- [ ] ENGINEERING ERROR
- [ ] TO IMPROVE DESIGN
- [ ] TO REDUCE COST
- [x] TO SUIT TOOLS OR FIXTURES

CHANGE REQUESTED BY	CHECKED FOR TOOLS	APPROVED
P.K.	F.C.K. PROD. ENG.	H.A.G. SUP'T

Fig. 1—Sample of change request. Complete records are mandatory on all drawing changes



CHANGE INVESTIGATION
(TO BE MADE BY DRAFTING DEPT.)

DW'G. NO'S. 80935

NAME OF PART #25 HOUSING

DESCRIPTION OF CHANGE PAD FOR INT. BORE RAISED TO H.S. BORE SURFACE

WILL CHANGE EFFECT OR REQUIRE	YES	NO	REMARKS	NO. OF DWG'S OR SHEETS	HRS. DRAWING AND CHECKING	COST
1 PRESENT DW'GS	✓			2	2½	5.00
2 NEW DW'GS		✓				
3 BILLS OF MATERIAL		✓				
4 GUIDE SHEETS		✓				
5 DIMENSION SHEETS		✓				
6 CATALOGUE		✓				
7 OTHER PARTS AND DW'GS						
8 TOOLS		✓				
9 PATTERNS	✓					15.00

REQUESTED BY P.K.
INVESTIGATED BY E.H.H.
RECOMMENDED BY H. KOURIN CHIEF DRAFTSMAN
REASONS FOR RECOMMENDING: TO ELIMINATE MORE THAN ONE SET UP

	QUANTITY	VALUED AT	REMARKS	DISPOSITION USE	CHANGE	SCRAP
10 PARTS IN FINISHED STOCK	22	$186.00		✓		
11 PARTS IN SEMI-FIN. STOCK	✓	✓				
12 PARTS IN ROUGH STOCK	✓	✓				
13 PARTS IN PROCESS	20	✓		✓		
14 PARTS ON PURCHASE ORDER		✓				

TOTAL COST OF EFFECTING CHANGE $20.00
ESTIMATED SAVING PER YEAR $400.00

	YES	NO
IF PRESENT DRAWINGS ARE CHANGED MUST DW'G NO. BE CHANGED		✓
CAN BILL OF MATERIAL BE CHANGED (INTERCHANGEABILITY AND REPLACEMENTS NOT EFFECTED)	✓	

APPROVED BY H.P.S.
REMARKS CHANGE TO BE MADE BEFORE PLACING NEXT STOCK ORDER.

Fig. 2—Investigation is conducted for each proposed change to determine effect on related activities

are filed numerically and alphabetically for reference purposes.

Drawing changes originate from many sources, among which may be cited: Customer's request, design revisions, improvements as a result of tests or other laboratory investigations, reduction in manufacturing and material costs to facilitate assembly. Regardless of how small the change may be, each must be properly recorded.

Good Prints Essential

Alterations to drawings, except those correcting minor errors, are made upon written request from the production manager, customer's letter, or general order. Change requests are recorded on a form as shown in *Fig.* 1. The extent to which changes affect printed information, tools and stock are recorded on the form illustrated in *Fig.* 2.

When making changes on drawings, a witness letter, the date, and a brief synopsis of the change is made in the alteration column of the drawing. All changes affecting work in shop are made immediately. On contemplated changes to standard parts, a notification goes out advising all departments concerned. They must then determine whether or not parts are to be scrapped, parts can be reworked, or whether change is to be effective after runout of parts on hand. Blueprints are made of drawings carrying changes and distributed to all departments. A record card accompanies each blueprint, and is signed by

the foreman of each department upon receiving prints. Card is then returned to record department for filing.

Modern equipment and materials must be used to supply the shop with clear, legible prints. The difference between a good print and a bad one may be only a matter of a few cents spent intelligently. Where additional original tracings are required, or where tracings become shopworn, reproductions are made by the photolithograph process. This process has advantages also on new work where parts of the design is a duplicate. A negative sepia print is made—portions of design not wanted are blocked out with pen and ink and a reproduction is then made. This gives the draftsman a head start on his new design. He merely draws in new sections as the case may demand. Facsimile copies of written, printed, typed, or drawn work where the original is not on transparent material are made on a photographic copy recording machine.

The drafting room is provided with modern furniture, good lighting and ample space. With the drafting tables that are used exclusively one can change board slope and height with little effort. Small hand machines for driving wire staples at one blow are used to fasten down drawings. Staples are easily removed and keep table tops in workable condition. An electric erasing machine for ink and pencil erasures is provided.

Designed for Passengers, Can Carry Bombs!

ANOTHER entrant in the fast field vying for commercial-military aircraft supremacy has made its appearance in the much-discussed Consolidated twin-engine flying boat shown in the illustration. Powered by two 18-cylinder twin-row radial engines, the flying boat weighs 50,000 pounds with a spread in its almost fragile-appearing wings of approximately 110 feet. It has been designated Model 31.

Requiring only ten months for its design and construction, the craft was constructed by Consolidated Aircraft Corp., San Diego, with the knowledge but without the financing or ordinary procurement routine of the U. S. Navy department. Development of models of similar magnitude has hitherto taken from two to three years.

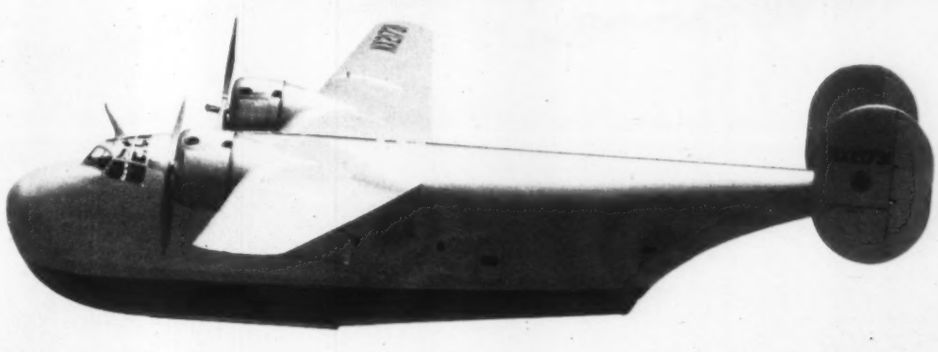
Superior to Other Bombers

As a commercial airliner, Model 31 has a maximum capacity of 52 passengers for day operations, and 28 sleeper passengers for night flying. Twenty-eight passengers also can be accommodated for transatlantic flights. If used for military purposes, the ship would augment the series of patrol bombers built for the Navy. The new model has much greater speed, range and load capacity.

The engines, rated at 2000 horsepower for takeoff, have 16-inch diameter three-blade Hamilton Standard hydromatic propellers. Length of the ship overall is 73 feet, height 22 feet, maximum wing chord 14 feet.

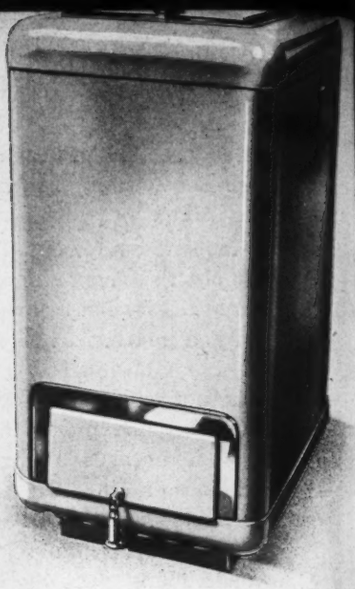
The wings, about which much comment has centered, are full cantilever with integral fuel tanks in the center section. Hydraulically operated flaps extend from the inboard side of ailerons to the hull. Outboard floats retract to the underside of the outer wing panel.

Aluminum-coated aluminum alloy skin has been used in the construction with internal reinforcement of longitudinal stiffeners and transverse bulkheads and frames. Wings, tail surfaces and the planing surface of the hull bottom are flush riveted. Tail surfaces have a full cantilever stabilizer with twin fins and rudders. Two full decks are in the hull, one above the other. The retractable tricycle beaching gear is hydraulically operated, with the nose wheel housed in a well in the bottom of the hull and the side wheels swung upward into wells in the side of the hull. Wheel wells are completely enclosed by doors in flight.



Model 31 flying boat can be used either as a commercial airliner or as a military bombing plane

The Southwark 500-ton single-acting hydraulic press (left) has an adjustable stripper in the descending platen. Self-contained, oil-operated, the press can be controlled manually, semi- or completely automatically. Side housings are cast steel. Pump, motor and valves, located at the top, are readily accessible. The machine makes 22 working strokes a minute



Frame of the narrow tread, cleanlined Mercury electric tractor (below) is channel iron, shrouded and integrated by welded steel plates into a unit including battery compartment and operator's seat. Drive axle is worm reduction type with transverse semielliptic spring suspension. Drum type controller provides three travel speeds forward and three reverse. Enamel finish is standard but stainless steel, chromium plated, is available

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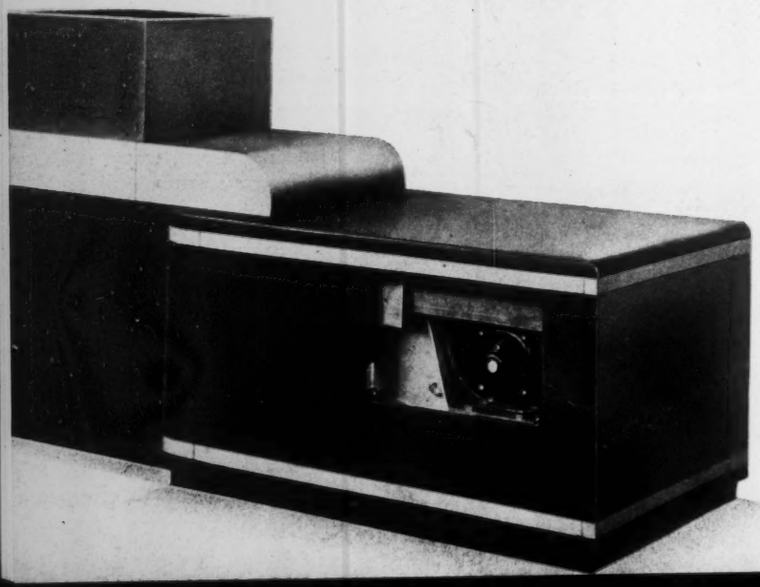
chinery

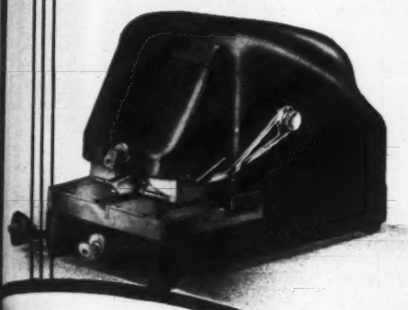
An electric vibrating feeder, synchronized to a continuous weigh belt, is enclosed in the attractive dust-proof metal sheath of the Jeffrey Waytrol (below) styled by Harold Van Doren. By sensitizing the feeder control panel an automatic all-electric "brain," which registers any slight unbalance of the weigh-belt, governs feed by making an instant correction in the vibrating feeder. The weigh-belt is driven by a synchronous motor through a gear reducer. On the scale of the weigh-belt beam is a counterpoise for establishing weighing rate

Blades and revolving shaft in the crystal container and square shank in the motor base of the Typhoon electric mixer (right) are stainless steel. All other metal parts are brass with heavy chromium plate. The mixer has a universal motor located in the center of the base

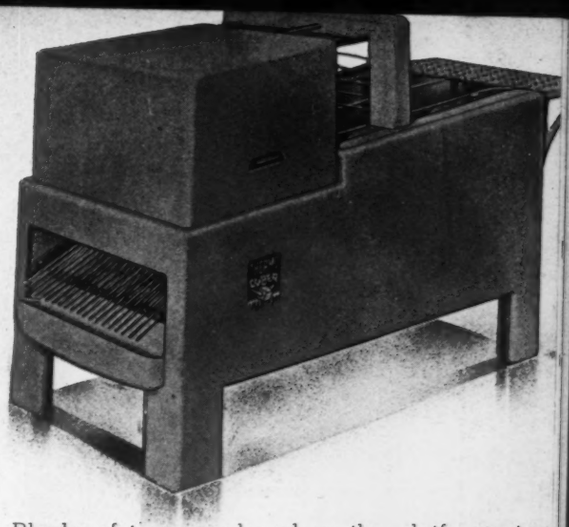


Fan and flywheel of the Onan (right) make up an integral cast Water pump is a centrifugal type the camshaft gear. Main and conn bearings are lubricated by an intern ing system, pumped by a plunger Other moving parts are lubricated from the crankshaft. One-cylinde engine and generator are solidly co mounting the frame on the crankcas type governor is used to regulate en and generator voltage outpu

...id-proof steel, welded into ...-piece unit, forms the com... ...amber of the Calcinator ...ator (left). Burners, either ...r electric, induce drying of ...ial to be consumed. A down... ...principle carries heat down ...gh the refuse, setting fire to it. ...at top is set on horizontal dowels ...op is insulated by a deep metal ... and thick asbestos pad. Ex... ...is white enamel, chrome trim



Aluminum cover castings of the American receipting perforator (left) have been curved to enhance eye appeal of the difficult original shapes without appreciable enlargement. An automatic overrunning clutch synchronized with the current control of the stop and start motor is a radical departure from previous design. Needle bearings insure durability and ease of operation



Blocks of ice are placed on the platform at the end of the Thermo cuber (above) and slide by gravity down an inclined stainless steel bed to the vertical slabbing grid comprising a series of horizontal steam-filled tubes which cut blocks into slabs. Two series of steam tubes at right angles to each other cut slabs to cubes. The cuber's exterior is porcelain enamel, beds are stainless steel, other metal surfaces are electroplated

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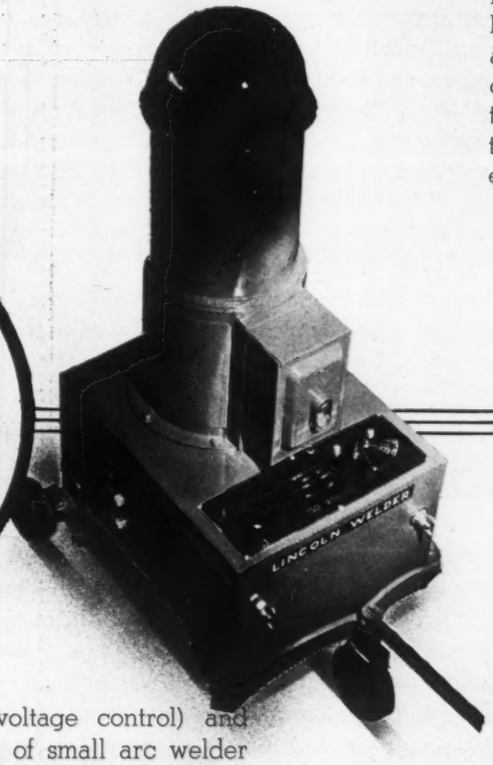
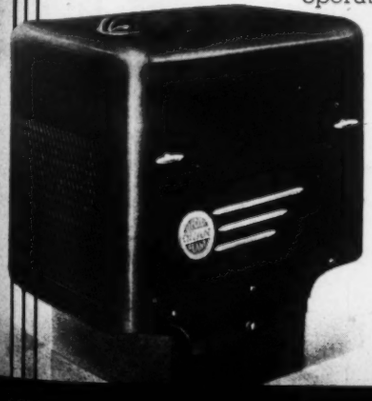
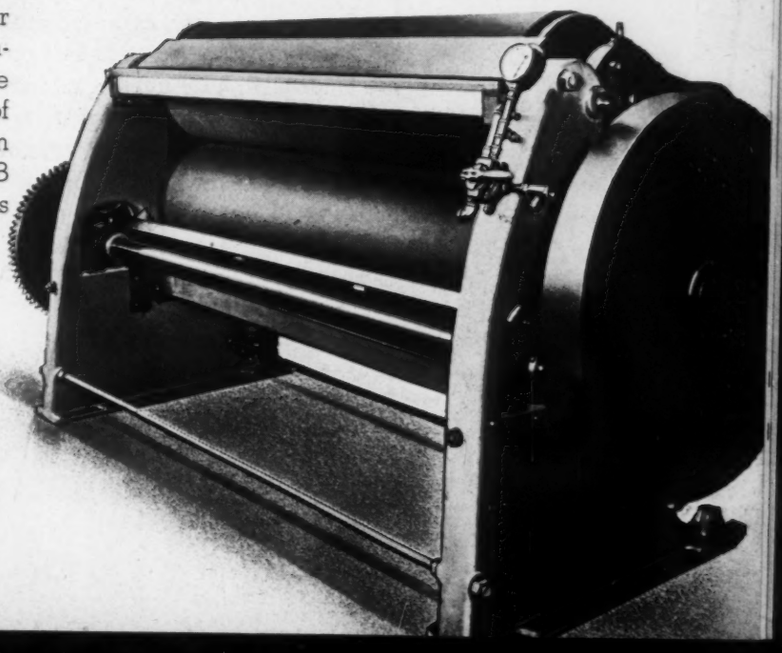


Job selector (voltage control) and current control of small arc welder (above) are calibrated and equipped with dials which indicate type of work and number of amperes for each setting, providing greater convenience and accuracy. Construction is arc welded drip-proof steel. Power is furnished by a squirrel-cage induction motor for across-the-line starting. A complete absence of flammable materials in this Lincoln unit, and the use instead of class B insulation at proper points, enables operation at overload conditions



Water in hydraulic cylinders at both sides of the Hunter cloth squeeze rolls (below) regulates pressure, indicated by a gage. Top roll is pulled down when water is forced into the top of the cylinders, while pressure is relieved when water goes into the bottom. Main frames are cast iron with smooth contours. Top roll is hung in a special lever arm. Variable speed is optional



We Can't Let Other Countries Outdo Us Mechanically!

ONE would think that an abundance of evidence had been published over the last several years regarding the advantages of the machine. That there is still much to be done, however, is apparent from the recurring queries from laymen and even some technical men as to whether machine progress is beneficial. These disturbing questions often crop up in the least expected quarters—even politically impartial, thinking men seem to be willing to "grasp at a straw" in an effort to point a finger of accusation to account for our present condition with regard to unemployment and low business activity. First it was the banker, then the farmer, now the machine. Rumors of wars have their inning, and when these do not mature the cycle starts all over again!

With the banker and the farmer in the background, at least for the time being, war scares and the machine age remain. And between these there happens to be a close relation. Latest reports are that in France, England and other countries in which preparedness is definitely an essential of national life, employment and activity in business are virtually at a peak. Research and engineering in those countries are going ahead at as rapid a rate, or even faster than during times of settled peace, and the last thought that arises is to retard machine production or development.

Contrasted with conditions there, we are giving comparatively little attention to preparedness but, at the same time, still have the major problem of unemployment—blamed by many, as previously mentioned, on machine development. Even congressmen and political leaders are considering the passage of legislation calculated to retard the development of any type of so-called labor-saving device, even to the extent of adding another tax burden on manufacturers in the form of a levy on production of goods by machinery because of its attendant "evils."

Where will we stand if such thinking prevails? This country has made more progress in relatively few decades—with one or two possible exceptions—than any country in the world. And the exceptions, notably Japan, are countries in which machinery, research and engineering in general are accorded their rightful place. Surely, in any discussion on the machine, those facts should be considered and due emphasis laid on the effect, not only of the immediate retrogression that would follow retardation of machine development, but of our eventual position if other countries are allowed to go ahead and leave us at a standstill. Unemployment is ripe now—it will be worse if engineering progress is forced to become stagnant.

By
William J. Travers
Krome-Alume Inc.

Typical aluminum, sand, permanent mold and die castings plated by new process which gives excellent adhesion

Research Uncovers Plating Process*

DESIRE to retain the favorable characteristics of aluminum and its alloys—light weight and relative cheapness—and to counteract simultaneously its defects of susceptibility to corrosion and relative softness, has led to strenuous efforts to coat it electrolytically with a hard, comparatively noncorrodible metal such as chromium or nickel. The principal difficulty to overcome has been lack of adhesion.

Most attempts were based on the assumption it was necessary first to remove the "oxide film," a layer always formed on an aluminum surface upon exposing it to any reacting agent, particularly an aqueous solution. Coupled with the attempts to remove this film was the evident result that the virgin metal surface exposed after elimination of the oxide film would, upon immersion in an electrolyte containing a metal such as chromium or nickel, immediately form a layer of this metal on the aluminum surface by displacement. As in the case of most metal layers so produced, there is very little adhesion.

No effort is made in the newly developed Krome-Alume process to prevent formation of the ordinary oxide film; instead a substantial film of the anodic type is purposely formed on the aluminum surface. It was discovered that an anodically treated surface of aluminum, subsequently subjected to a chemical reduction or modifying reaction, will make the surface susceptible to receiving a very adherent and impervious electrodeposit. The anodic film may be formed on the aluminum surface in a variety of electrolytes, both acid and alkaline, best results apparently coming from use of solutions of certain organic acids, oxalic acid for example. Temperature of the electrolytes is about 70 degrees Fahr. Exact nature of the anodic film thus formed has not been determined but it is thought to be of rather complicated composition and made up of a hydrated aluminum oxide together with a gaseous component. Alternating current over a voltage range of 20 to 50 volts is generally used because of its freedom from polarizing effects and its greater availability.

The aluminum article is cleaned in any good, mildly alkaline cleaner free of silicates. No etching of the surface is necessary. After cleaning, the article is anodized in oxalic acid for ten minutes at 50 volts alternating current. A number of similar pieces are so disposed in the tank that each article serves as a counter-electrode for those adjacent to it.

After anodization the article is rinsed in cold water and placed in a sodium cyanide solution for from 12 to 14 minutes. The "end point" of this reaction can be determined by indicators and the change of appearance of the film itself. Ready then to be plated, the aluminum article is usually given an initial coating of nickel on top of which other metals may be deposited.

Various theories have been proposed to account for the good adhesion obtained in this process, but too little is known about the actual changes taking place in the surface of the metal. Perhaps the most plausible theory is that the anodic treatment pierces the anodic film with millions of tiny holes, permitting the subsequent nickel plate to anchor itself to the virgin metal surface underneath. In the case of most of the aluminum base alloys this adhesion is superior to that between the more commonly plated metal bases and their coatings.

**From a paper presented at the Seventy-fifth general meeting, The Electrochemical Society.*

ASSETS *to a* BOOKCASE

Theory of Application of Electron Tubes

By Herbert J. Reich, published by McGraw-Hill Book Co., New York; 6 by 9 inches, 670 pages, cloth; available through MACHINE DESIGN *for $5 postpaid.*

Fundamental principles of electron tubes and associated circuits are coordinated, presenting a thorough grounding in the theory of electron tubes to enable their application in the solution of new problems. The author has not attempted to discuss all applications to special problems but rather to cover basic principles and typical applications. Principles presented are applicable to industrial electronics, power control, electrical measurements and other fields of use as well as radio engineering problems.

Series expansion for electrode currents is the basis of the analysis of high vacuum tubes and associated circuits operation. Outlines of these derivations are included. Equivalent circuits and graphical methods of analysis are stressed throughout the book.

Since the operation of most tubes is dependent upon thermionic emission, its theory is of importance. Basic principles, construction of emitters, and flow of electron space current in high vacuum tubes containing two electrodes are discussed. Modulation and detection are covered with relation to application and factors affecting amplification and distortion.

Types of oscillators, their characteristics and uses are fully described together with electrical conduction in gases, glow discharge, arc discharges, deionization and methods of control. Light sensitive tubes and cells are discussed with respect to the factors controlling their operation by incident radiant energy. Power supplies and electron tube instruments are also included. In the appendix are curves for determining tube characteristics and operating data.

□ □ □

Direct-Current Machinery

By Thomas C. McFarland; published by International Textbook Co., Scranton, Pa.; 5½ by 8½ inches, 440 pages, flexibly bound; available through MACHINE DESIGN *for $4 postpaid.*

In this book the author presents the physical elements of direct-current machines with respect to characteristics and reasons for design compromises. This is followed by a discussion of operating characteristics and control proceeding from no-load to load operation. Design material in the treatment of no-load saturation curve and of armature reaction is included to show the compromises necessary in constructing machines and why they behave as they do.

Fundamental concepts of electricity and magnetism are reviewed in the first chapter for complete understanding of the ensuing material. Assembly of machines, functions of each part and their interrelation are comprehensively treated. Features of separately excited, shunt, series and compound generators are each discussed in separate chapters. Special generators, such as welding and battery charging, are also included.

Chapters on motors are developed with similar treatment. Methods for computing efficiency and heat losses are described together with conditions for maximum efficiency. Because commutation is an important factor in operation a chapter is devoted to causes for poor commutation and its correction. Installation and operation of machines are treated generally with respect to proper selection of equipment for conditions and results desired.

□ □ □

Heating, Ventilating, Air Conditioning Guide

Published by American Society of Heating and Ventilating Engineers, New York; 6 by 9 inches, 1160 pages, flexibly bound; available through MACHINE DESIGN *for $5 (deluxe edition with thumb index $5.50) postpaid.*

THIS guide for 1939 contains reference material on the design and specification of heating, ventilating and air conditioning systems. Of particular use is the extensive data in the form of tables and curves. Included among the chapters are discussions on the properties of air, water, steam, refrigerants, and air pollution. Heat transmission of various materials and constructions, combustion, methods and systems for heating and cooling, humidity control, air cleaning, fans, circulation, sound control and acceptable noise levels are discussed. Also, chapters on automatic control and motors are included.

Men of Machines

ACTIVE in the affairs of the American Society of Agricultural Engineers since its beginning, K. J. T. Ekblaw has been elected president of the society. Mr. Ekblaw, who is agricultural engineer of the American Zinc institute and vice president of the Western Advertising Agency, began his work as associate in agricultural engineering at the University of Illinois and became head of this department. He later obtained his mechanical engineering degree at Yale university and then joined the faculty of Kansas State college, organizing its department of farm engineering. During the last twenty years he has done extensive work in the farm structures field, particularly along educational lines. He also served as editor for a group of farm papers and is an author of several books and numerous pamphlets on farm building subjects.

K. J. T. EKBLAW

WILLIAM L. DITGES has recently been appointed chief engineer of The Morgan Engineering Co., Alliance, Ohio. Mr. Ditges' career includes considerable experience in the steel industry, having been identified in various capacities with this industry since graduating from college. He has been employed in the engineering departments of both Carnegie Steel Co. and Bethlehem Steel Co.

Mr. Ditges joined the engineering staff of Mackintosh-Hemphill Co., Pittsburgh, manufacturers of rolling mill machinery, and was advanced successively to the positions of chief engineer and vice president in charge of design of rolling mills and auxiliary rolling mill machinery. Previous to his present appointment he had been connected with the Mesta Machine Co., rolling mill machinery manufacturers also, for the last four years.

WILLIAM L. DITGES

COMING through the ranks of a student engineer to vice president in charge of all the engineering activities of Westinghouse Electric & Mfg. Co., is the record of Marvin W. Smith. He was formerly manager of engineering of the company.

Born in Overton, Texas, in 1893, Mr. Smith attended school in that city and in 1915 graduated from Texas Agricultural and Mechanical college as valedictorian and with a degree of bachelor of science in electrical engineering. Because he was "interested in the design and application of electrical apparatus and machinery more than anything else", Mr. Smith enrolled in the student engineering course immediately after leaving college. He was then selected to work for six months in the office of the late B. G. Lamme, studying special design problems. Two years later he was assigned

MARVIN W. SMITH

to the power engineering department where the company's large rotating electrical machinery was designed and manufactured. Here he began as design engineer. Rising steadily in the department he became section engineer in 1927 and division engineer in 1930, which position he held until 1936 when he was appointed manager of engineering.

♦

GUIDO G. BEHN, who previously had been chief engineer of the Hudson Motor Car Co. for twenty years, has returned to the organization in his new capacity as member of the board of directors. In 1909 as executive engineer, he joined the original group that founded the Hudson Motor Car Co., and a year later became head of the engineering department, serving in that capacity until 1929 when he retired.

♦

WILLIAM M. BRISTOL JR., vice president of Bristol-Myers Co., Hillside, N. J., has been elected president of the recently formed Packaging Institute Inc. Carl H. Lambelet, president of New Jersey Machine Corp., has been named vice president.

♦

L. E. NICHOLS, formerly chief welding engineer of National Electric Welding Machines Co., has been named technical advisor and sales engineer of the company's Detroit district office.

♦

J. A. CARLIN, identified for many years with Hutto Engineering Co., has been made president of the newly formed Honing Equipment Corp., Detroit. C. W. FLOSS, formerly with Jeschke Tool Corp., becomes vice president in charge of engineering.

♦

SAMUEL L. HOYT has become a member of the staff of Battelle Memorial Institute, Columbus. Mr. Hoyt formerly was director of metallurgical research of A. O. Smith Corp., and is known for his work on heat resistant alloys.

♦

JAMES P. GILL of Vanadium Alloys Steel Co. has been nominated as president of the American Society for Metals for 1939-40. DR. OSCAR E. HARDER of Battelle Memorial institute has been nominated for vice president.

♦

G. S. CRANE will supervise the development work of Cutler-Hammer Inc. as well as the engineering, drafting and patent departments. He has been with the company for twenty-nine years.

♦

DR. HARRY A. SCHWARTZ, associated with National Malleable & Steel Castings Co., Cleveland, as director of research, has been awarded the E. J. Fox gold medal by the British Institute of Foundrymen. Dr. Schwartz is in England to receive the award which is going for the first time to an American.

♦

C. F. GOEDKE, president of Ganschow Gear Co., was elected president of the American Gear Manufacturers' association at its recent annual meeting. U. SETH EBERHARDT, vice president and general manager of Newark Gear Cutting Machine Co., has been named vice president of the association.

♦

DEANE G. CARTER, professor and head of the agricultural engineering department at the University of Arkansas, has been appointed dean of the college of agriculture and director of the agricultural experiment station at the institution.

♦

R. P. JOHNSON has recently been appointed chief engineer of The Baldwin Locomotive Works. A mechanical engineering graduate of Cornell university in 1912, he has served apprenticeships in the various shops of the company. Later he joined Remington Arms Co. as metallurgical engineer. After serving in the war, he returned to Baldwin Locomotive Works as chief service engineer. In January of this year he was made general sales manager, and now chief engineer.

♦

W. D. SIZER, who has been connected with Worthington Pump & Machinery Corp., Harrison, N. J., has been named executive engineer in charge of all engineering activities at Harrison. B. R. MCBATH succeeds Mr. Sizer and is in charge of the centrifugal division.

♦

H. H. MORGAN, manager of the rail and track fastenings department of Robert W. Hunt Co., has been nominated for president of the American Society for Testing Materials. Since his graduation in 1904 Mr. Morgan has been connected with this company and consequently has been closely in touch with testing, inspection and research problems in the field of materials.

♦

K. J. DEJUHASZ has been awarded the Levy gold medal by the Franklin Institute of Philadelphia for his paper on "Graphical Analysis of Surges in Mechanical Springs." He is associate professor of engineering research at the Pennsylvania State college.

♦

MARSHALL POST, vice president of Birdsboro Steel Foundry & Machine Co., has been elected a director of the American Foundrymen's association for a three-year term. Mr. Post has served as director and vice president and is the immediate past president of the association.

NOTEWORTHY PATENTS

Spinner Rings Prevent Leakage

PROBLEMS associated with protection of bearings from fluids being processed under pressure have been solved by the use of spinner rings and labyrinths in an homogenizing apparatus operating under pressures up to 150 pounds per square inch and 4000 revolutions per minute.

In *Fig.* 1 is shown the design of the apparatus whereby a coarse liquid suspension enters at the top

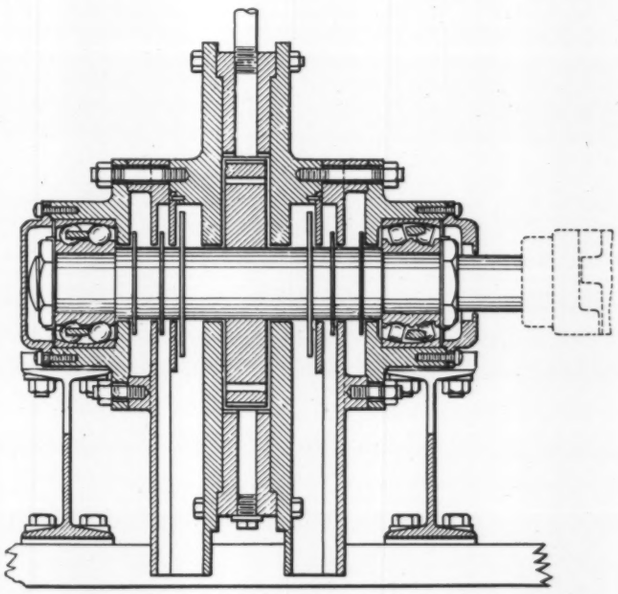


Fig. 1—*Spinner rings and reduced pressure on discharge prevent leakage of unit*

inlet under sufficient pressure to overcome resistance and centrifugal action of the rotor. Clearance between the rotor and housing is limited to produce a shearing action on the particles reducing them to an homogeneous emulsion.

Pressure of the feed forces the emulsified liquid through the clearance between rotor shaft and housing into the outlet channels. These channels are so proportioned that no back pressure will be exerted on the fluid. By centrifugal action, spinner rings and splash plates prevent the material from traveling along the shaft and reaching the bearing. Whatever leakage may occur beyond the splash plates is removed in a drip chamber adjacent the bearings. This chamber also prevents leakage of lubricating oil from the bearings into the process material. Thus by effectively reducing the pressure at the bearings to atmosphere and providing baffles, the possibility of leakage is practically eliminated. Designed by Sheldon B. Heath and Forest R. Minger and assigned to the Dow Chemical Co., this apparatus is covered by patent 2,153,537.

Controls Clutch Engagement

DESIGNED to engage at synchronous speed and eliminate the shock associated with non-spring overrunning clutches, the clutch illustrated in *Fig.* 2 operates through rolling motion of the cam members as shown. Because centrifugal action on the wedge members is ineffective, the rotational speed does not materially affect its operation.

Engagement is entirely dependent upon the characteristics of spring members so chosen to give the desired action. In operation, the driving member advances relative to the driven member causing the cams to rotate into locking position. Should the driving force be relieved, the momentum of the load will turn the cams to free position and permit overrunning of the driving part.

Tendency of the wedge members to be thrown against the driven member by centrifugal force is precluded by flanges on the rings retaining the members.

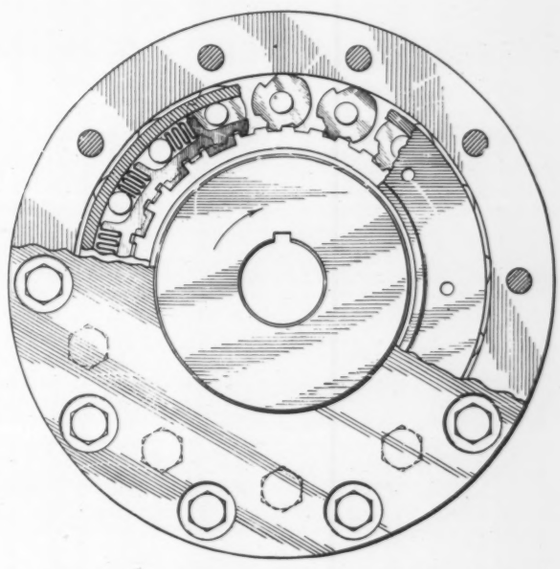


Fig. 2—*Operation of overrunning clutch is not affected by centrifugal action on wedge members*

The clutch is therefore free to overrun with a minimum of frictional resistance. This becomes important at high speeds by not affecting the action of the springs which urge clutch engagement. Thus, as the driving member comes up to speed engagement takes place at synchronous speed without shock to the system.

Wedge members in this clutch, designed by Alfred Moorhouse and covered by patent 2,154,212 assigned to the Morse Chain Co., are balanced against rotative tendencies of centrifugal action. Spring members bearing against the cams are calibrated to provide sufficient frictional engagement for rocking the cams and quick engagement of the clutch. Friction is minimized and efficiency increased through proper selection of springs.

Conveyor Applied to Toaster

UTILIZING the principle of continuous conveyors, a domestic bread toaster receives slices of bread at one end and automatically delivers toast at the other. This unusual design, invented by Harry R. Mitchell and covered by patent 2,151,790 is illustrated in *Fig.* 3.

Enclosed within the base and shown in detail in the insert, a two-speed reduction gear and motor drive the conveyor at one of two selected speeds to supply either light or dark toast. Either train of gears is engaged by a selective clutch controlled by knob at toaster end.

Shifting is accomplished by a yoke mounted on a shaft on which is a pin eccentrically carried on a rock shaft. A spring permits excess movement of this shaft with relation to the clutch element and insures meshing of ratchet teeth on the clutch. Clutch elements are spaced insufficiently to permit a neutral position, thus assuring that the conveyor is in motion at all times while the toaster is in operation.

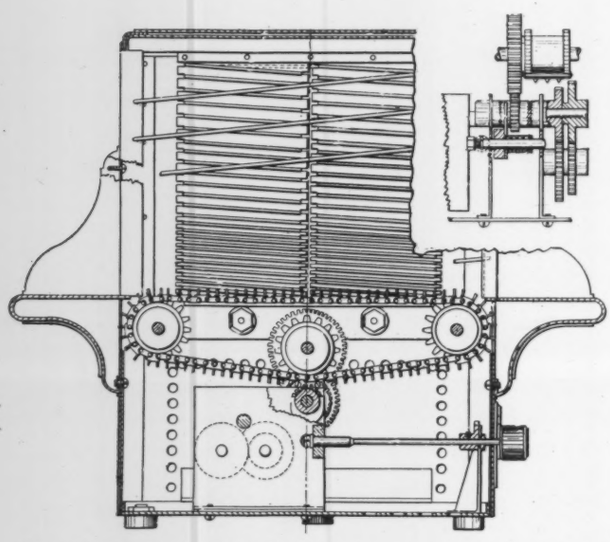


Fig. 3—Two-speed drive operates conveyor for carrying bread slices through toaster. Insert shows gear reduction and clutch arrangement

Upper run of the conveyor chain is carried by a sprocket wheel at each end. The return is within the base and engages a third sprocket which is the driving member associated with the gear reduction unit. Lugs on the chain together with downward slanting guide bars provide positive movement of bread slices.

Ball Threads Increase Starter Turns

ANOTHER interesting use of ball threads is employed in an hydraulic aircraft engine starter covered by patent 2,144,196. Designed by R. M. Nardone and assigned to Eclipse Aviation Corp., this starter, shown in Fig. 4, obtains a large number of turns of the crank for a short piston travel through a ball thread converter.

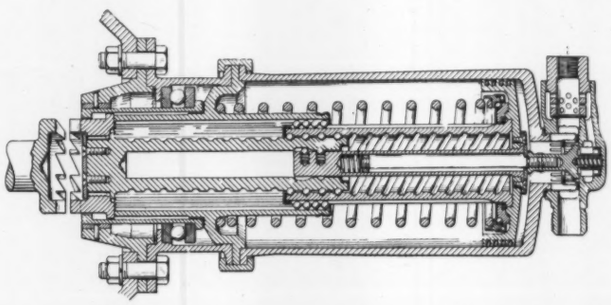


Fig. 4—Large number of starter turns with short piston travel is provided through ball threads

Precompressed air or an explosive cartridge supplies the motive force for the starter. The initial pressure causes engagement of the ratchet jaw. Upon completion of this axial movement the ball threads turn the starting shaft while the piston travels forward. During this stroke the fluid pressure and a spring keep the exhaust valve closed. This valve is shown below the inlet valve at the right of the illustration.

As the piston nearly reaches the end of its stroke, a collar on the piston head acts on the spring to unseat the exhaust valve. It is then held open by a small spring shown in the valve during the exhaust motion. Spring action returns the piston to starting position while scavenging the cylinder through the exhaust port.

The exhaust valve is again seated by the collar engaging the valve stem at the other end of the stroke. Should excessive pressure develop, a relief diaphragm will break and allow the pressure to escape to atmosphere thus protecting the starter parts from any damage which might otherwise result to either the starter or driven parts.

Other recently designed devices employing ball members include torque converters and automobile steering gears as described in *M. D.* for Dec. 1937 and Feb. 1939.

NEW Materials and Parts

(For Engineering Department Equipment see Page 68)

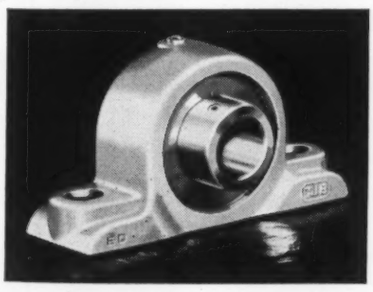
Pushbutton Stations Announced

A NEW line of standard duty pushbutton control stations has been developed by the Allen-Bradley Co., 1311 South First street, Milwaukee. Enclosures consist of reinforced plastic covers mounted on a die-cast frame. By removing a single screw the cover can be taken off, exposing all terminals. The pushbutton mechanism is unit type and can be removed from the frame. Double-break, silver contacts are located in recessed chambers. Available in both horizontal and vertical arrangements these pushbutton stations have a maximum direct current rating of 1 ampere, 115 volts; .5 ampere, 230 volts; .25 ampere, 550 volts. Maximum alternating current rating is 3 amperes, 110-220-440-550 volts.

Reinforced plastic covers on die-cast frames enclose new line of pushbutton control stations

Pillow Blocks for Light Machines

A NEW series of light-duty ball bearing pillow blocks is being offered by Ahlberg Bearing Co., Chicago. Cataloged as series ED, these units are designed to make antifriction efficiency practical for many light machine applications where the cost of ball bearings has heretofore been prohibitive. They consist of a special Ahlberg single row bearing in a sturdy and neat die-cast housing, the bearing being assembled to provide for shaft deflection and misalignment up to one degree. Neoprene seals are of floating construction, eliminating friction and increasing life of both seals and bearing. Standard shaft sizes are ½, ⅝, ¾, 15/16, 1, 1⅛, and 1-3/16-inch. Machines for which these pillow blocks are particularly suitable include domestic airconditioning equipment, fans, packaging and labeling machines, models, laboratory equipment, displays, etc.



Ball bearing pillow blocks are designed for light duty where cost heretofore was prohibitive

Timer Controls Welding Current

FOR use with spot, butt and projection welding machines, to control automatically the length of time the current is allowed to flow through the pieces being welded, a Neotron weld timer has been announced by The Electric Controller & Mfg. Co., 2706 East Seventy-ninth street, Cleveland. The timer operates on the principle of time required to charge a condenser to a predetermined voltage. When this voltage is reached, the condenser discharges through a Neon tube to open the magnetic contactor handling the main power circuit to the welding machine. A definite time is given for each weld. When used on 60-cycle frequency this timer gives a selection of time varying from ½ to 60 cycles by operating two small adjusting dials on the front of the panel. For greater length of time, a timer with larger condenser is available to give a time range from 1 to 120 cycles. A

Length of time that current is allowed to flow through pieces being welded is controlled automatically by timer

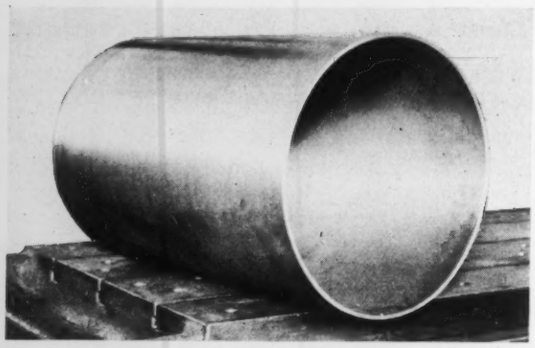
still greater time up to 300 cycles can be secured when required.

Electrodes Cover All Analyses

COVERING all chemical analyses, a complete line of stainless steel electrodes is offered by The McKay Co., Pittsburgh. Spatter free within practical limits, these electrodes make instant contact upon restriking an arc and provide maximum ease of slag removal. An exceptionally smooth bead with perfect weld contour is made.

Two New Casting Metals Developed

CO-OPERATIVE research by members of the Meehanite Research Institute of America Inc., 311 Ross street, Pittsburgh, has developed two new types of metal to be known as Super A and Super WH Meehanite. Super A is an alloyed Meehanite which uses copper largely as the base alloy and provides a great increase in hardness and wearing qualities accompanied by an increase in machinability. Practical applications for this metal include internal combustion engines, marine cylinders, and other machinery which

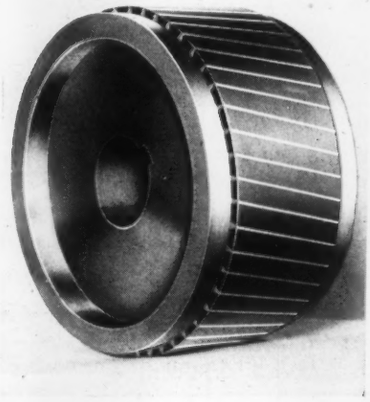


Two new types of Meehanite metal have been developed, giving an increase in wearing qualities for machinery which must run smoothly

must primarily run smoothly, as well as large gears, piston rings, and parts operating under severe wearing conditions. The metal has a high modulus of elasticity, a good degree of toughness, and a tensile strength over 50,000 pounds per square inch. Super WH Meehanite is an unusually wear-resistant material possessing a good combination of physical properties and may be made with Brinell hardnesses up to 578, according to the service requirements. It has been used in castings such as ball mill liners, muller tires, and pan bottoms.

Centrifugally Cast Copper for Rotor

FAIRBANKS, MORSE & CO., Chicago, announces a one-piece centrifugally cast Copperspun rotor for polyphase squirrel-cage motors. Made of pure copper, the rotor's bars and end rings are formed in one piece by pouring molten copper into a mold encasing the punched laminations, stacked and held under pressure. Copper is poured from one end only as the entire assembly is spun at high speed. The opposite end ring is formed by material that has passed

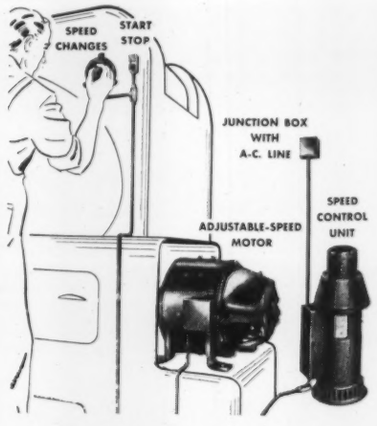


Centrifugally cast one-piece rotors for polyphase squirrel-cage motors are for severe service

through the rotor slots insuring a fluid material during the casting process. Centrifugal force brings a tough, dense, ductile copper winding. This rotor is especially adapted to severe service such as plugging or reversing duty.

Adjustable Speed Drive Developed

AN ALL-ELECTRIC, alternating current, adjustable speed drive which employs a proved principle of speed control heretofore confined to large units has been developed by The Reliance Electric & Engineering Co., Cleveland. The new drive consists of a control unit and an adjustable-speed motor applied directly to the machine, this combination being intended to bring to motor users having only an alternating current power supply, an economical means of varying the operating speeds of their small motors over as much as a 12 to 1 range. The speed control unit has been designed for use on three-phase, 60-



Adjustable speed drive includes a control unit and an adjustable speed motor for application to machine

cycle, 220, 440, and 550-volt alternating current circuits. Secondary circuits run from the control unit to the driving motor, to a speed adjuster and to start

THE *Vital Point* OF EVERY HYDRAULIC PRESS

IS ITS OPERATING SYSTEM

This is appreciated by every press builder who fully realizes that today the value of a press is not measured by how well it does one job – but many. And VERSATILITY of application rests with its operating system.

THE HYDRO-POWER HYDRAULIC SYSTEM OF OPERATION gives every press builder the opportunity of incorporating VERSATILITY in his presses so essential in meeting modern production requirements. On the larger presses HYDRO-POWER Closed Circuit provides speed of operation and delicate control otherwise not obtainable.

THE HYDRO-POWER HYDRAULIC SYSTEM OF OPERATION is flexible and readily adaptable to any type of hydraulic actuated press. It owes much of its success, substantiated by hundreds of important press installations, to the HYDRO-POWER RADIAL PUMP that far surpasses conventional design in principle and service rendered.

THE HYDRO-POWER HYDRAULIC OPERATING SYSTEM is designed particularly for presses. It is complete in every detail with all controls and regulation elements of HYDRO-POWER manufacture.

Call in a Hydro-Power Engineer to discuss the HYDRO-POWER OPERATING SYSTEM with you in detail – and how it can be applied to your presses to advantage.

HYDRO-POWER SYSTEMS, Inc

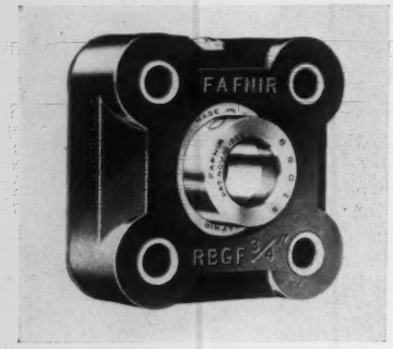
HYDRAULIC DRIVES • FOR MODERN MACHINERY

MOUNT GILEAD, OHIO, U. S. A.

and stop buttons. A Reliance type T is the driving motor, supplied in a variety of types including enclosed fan-cooled, splashproof and explosionproof. Gear motors may also be used. The motor can be started and stopped without interfering with the speed setting and the speed can be changed while the motor is in operation. No clutches of any kind are needed.

Rubber Bearing Cartridges on Market

FLANGE and cylindrical all-rubber bearing cartridges have been made available by The Fafnir Bearing Co., New Britain, Conn. The completely resilient housing insulates the bearing, absorbs noise and vibration, and automatically compensates for small errors of alignment and longitudinal shaft expansion. Developed primarily for the heating, ventilating and



Resilient housing of bearing cartridge insulates the bearing, absorbs noise and vibration, compensates for misalignment

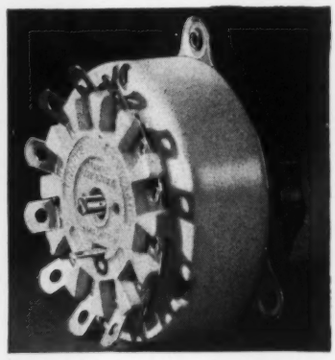
airconditioning fields, these new units may be employed wherever these advantages are desired. The rubber flange cartridge is available for all standard shaft diameters from ¾ to 1-7/16-inches. Each of these units embodies a Fafnir wide inner ring ball bearing with exclusive self-locking collar, bored to inch rather than metric dimensions, for slip fit on stock shafting. It can be easily installed without machining, locknuts, sleeves or adapters.

End Fittings Welded to Metal Tubing

ATTACHMENT of metal end fittings and end seals to metallic tubing by means of electric resistance welding is announced by Chicago Metal Hose Corp., Chicago. Designed principally for use with stainless steel tubing and stainless steel bellows, this development permits the fabrication of completely sealed vacuum tight units free from soldered, brazed or torch welded joints of any kind.

Tap Switch Has Twelve Contacts

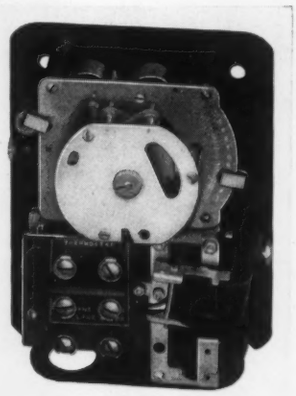
MODEL 412, a 40-ampere tap switch, is one of a complete new series of high amperage heavy-duty rotary tap switches with multipoint selectors announced by the Ohmite Mfg. Co., 4835 Flournoy street, Chicago. Rated for a 240-volt alternating current, noninductive circuit, this switch is 4 inches in diameter and is equipped with a maximum of 12 contacts. Compact, all-enclosed, its current-carrying parts are silver plated. Designed for single or tandem mounting, the switch has all-porcelain high voltage insulation between contacts and shaft and mounting plate. It can be used to meet circuit switching requirements for battery chargers, X-ray and diathermy equipment, tapped transformers, radio transmitters, arc welders, spot welders, ventilating fans, motor controls and many other applications.



Designed for single or tandem mounting, tap switch with multipoint selectors meets circuit switching needs

Stoker Control Needs No Lubrication

DISTINGUISHING feature of the THV stoker control recently announced by The Mercoid Corp., 4201 Belmont avenue, Chicago, is the heat motor, which operates a gearless mechanism having only one rotating member turning at one revolution per hour.



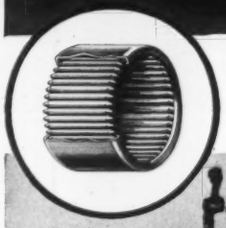
Heat motor in stoker control has rotating member revolving only once per hour, reducing wear of unit

This slow operating speed reduces wear and assures longer life. The THV requires no lubrication, a frequent source of trouble under varying temperature conditions. Electrical capacity is 10 amperes, 115 volts, or 5 amperes, 230 volts.

Beryllium Alloy Shapes Available

COMMERCIAL production of heat treated beryllium alloys in rod, strip and wire form has been announced by The Beryllium Corp. of Pennsylvania, Reading, Pa. Alloys available include 2 to 2.25 per

705,000,000 POUNDS OF IMPACT!



Above—Photo of the Torrington Needle Bearing in a rocker arm from the test engine of the Ranger Engineering Corp., Farmingdale, N. Y. Note the perfect appearance of the bearing and shaft which served directly as the inner race.

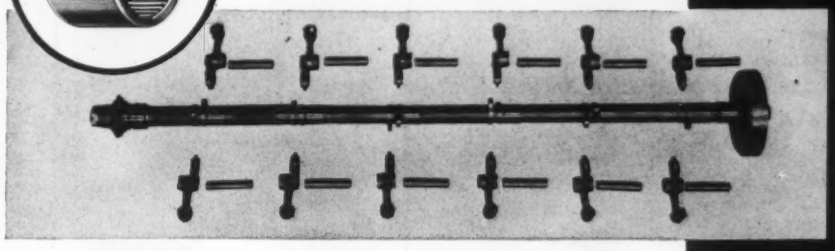
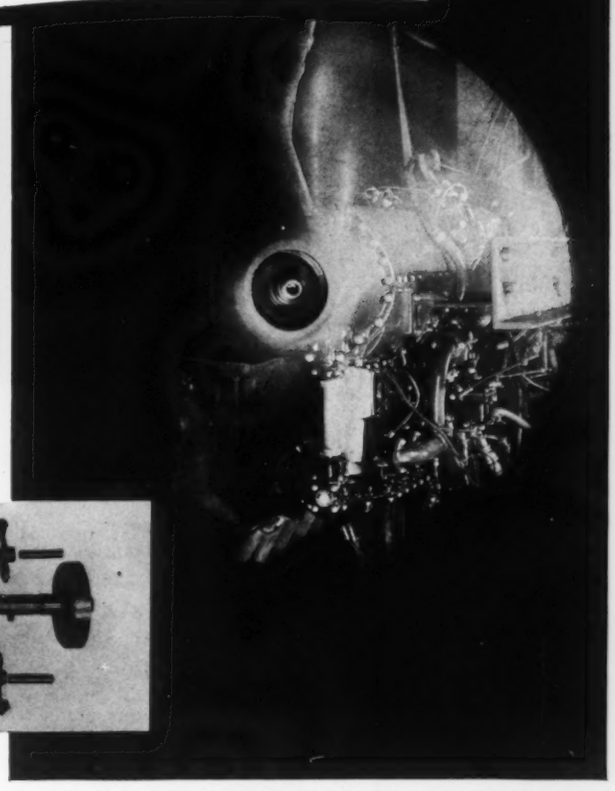


Photo above shows the camshaft and twelve rocker arms after disassembly. The camshaft rotated at 1,225 R.P.M., half engine speed.



One of the most grueling tests ever put upon an Aircraft Engine.

50-Hour, Full-throttle, Non-stop Test in Ranger Aircraft Engine Proves Torrington Needle Bearings can take it.

IMAGINE a cumulative load of 705,000,000 pounds impact in a 50-hour period—produced by 3,525,000 separate oscillations. Each oscillation imposed an impact load of 200 pounds on each of the Torrington Needle Bearings in the valve rocker arms of the Ranger Model 6-410 six-cylinder engine during a fifty-hour, full-throttle test—one of the most grueling tests which can be imposed on an aircraft engine, *a test calculated to wreck any part not perfectly engineered to its job.*

The acceleration on the bearing race was at the rate of 656 feet per second per second—an acceleration equivalent to a speed increase of 0 to 447 miles per hour in one second.

The rocker arm bearings showed no sign of wear when inspected at the end of the test. This means that rebushing on every overhaul, always a costly maintenance job in aircraft operation, will be eliminated.

But even more important are other characteristic advantages of the Torrington Needle Bearing which make it the ideal bearing for many aircraft, automotive and industrial applications. Its high radial load capacity, its small, compact size which requires no more space than a simple bushing, the extremely simplified housing required, the resulting weight reductions, all contribute to better design, greater operating efficiency and production economies.

The Torrington Needle Bearing is also surprisingly low in *unit cost* compared to any other type of anti-friction bearing.

Let our engineering department give you a demonstration of these advantages put to work in your own product so you can estimate your own increased efficiency and cost savings. We will be glad to work with you in adapting the Needle Bearing to your product requirements. Write for the Torrington Needle Bearing Catalog No. 9.

For Needle Bearings to be used in heavier service, request Booklet 103X from our associate, the Bantam Bearings Corporation at South Bend, Indiana.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Makers of Ball and Needle Bearings
Branch Offices in all Principal Cities

TORRINGTON
NEEDLE BEARING

CLEVELAND DRIVES MAKE MACHINES PAY BACK FASTER BECAUSE:

NO STUTTERING UNDER SHOCK LOADS

Even the heaviest emergency loads cannot stop the "Cleveland" that's built for the job —for Cleveland Worm Gear Speed Reducers simply take the shock loads as they come and keep right on going!

The greatest tributes paid to Clevelands' sound engineering, precision manufacturing, correct application, and long endurance under the most trying conditions, are not in what we *say* but in the way they perform in service.

Among Cleveland's most loyal customers today are the builders, large and small, of production machinery for every major industry. Scores of these Companies began long ago to specify and purchase Cleveland Worm Gear Speed Reducers—and have continued "repeating" for 10 years, or 20—or even longer.

Does your daily reference library include a copy of the Book "Cleveland Worm Gear Speed Reducers?" The Cleveland Worm & Gear Company, 3275 East 80th St., Cleveland, Ohio.

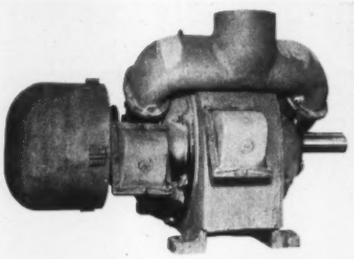
Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication

CLEVELAND WORM GEAR Speed Reducers

cent beryllium-copper, beryllium-cobalt-copper, beryllium-chromium-copper, beryllium-nickel, and others. These alloys possess desirable qualities—high electrical conductivities and tensile strength, elastic stability, resistance to fatigue, heat and wear, and uniform hardening characteristics—which are of particular value for small machine parts, springs, aviation instruments. Hitherto, primary shapes of these alloys have been difficult to fabricate uniformly, and available analyses have been limited.

Oil Drilling Motors Announced

A COMPLETE line of wound-rotor alternating current draw-works, mud pump and table motors for oil well drilling is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. Of special interest in this design are a protected collector assembly with liberal spacing of collector rings, generous heat radiating surface, and a construction of enclosed rings and leads to withstand high operating temperatures. These motors may be equip-

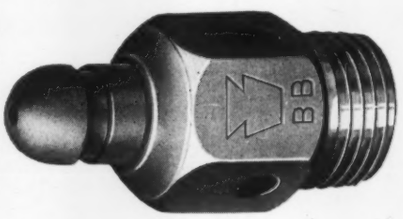


Protected collector assembly with liberal spacing of collector rings is feature of wound-rotor draw-works motor

ped with thermoguard to give protection against unsafe motor winding temperatures when motors are overloaded. The standard line includes motors with gas protected collectors, and with frames of open type construction, or splashproof construction which may be arranged with or for forced ventilation. Motors are available in ratings of from 50 to 500-horsepower, three phase, 50-60 cycles.

Adds to Line of Fittings

KEYSTONE LUBRICATING CO., Philadelphia, announces an addition to its line of Keystone BB fittings. When the new combination type is employed it is unnecessary to install a high pressure fitting, as the ball head of the combination fitting is de-



Ballhead of combination fitting, reissue patent No. 20743, is designed for direct contact with nozzles of standard grease guns

signed for direct contact with the nozzles of standard push type or hydraulic high pressure grease guns.

MAKE YOUR MACHINES

Talk Business

WITH BUILT-IN COUNTING DEVICES

In some machines, Veeder-Root Counters watch, count, and record operations and production. In others, they control outputs—eliminate short or over-runs. Again, as in modern gasoline pumps, they actually compute in dollars and cents the cost of the gallons pumped out.

Veeder-Root Counters talk business—give accurate, reliable information, always at an instant's notice. Operators know what their machines are doing. You have proof of your product's performance.

Veeder-Root Engineers are constantly finding, for manufacturers, profitable applications of counting devices that usually result in sales. If you want to see some of the things they have done—with the idea of finding out what can be done for you—write, now, for our free booklet: "Counting Devices."

VEEDER-ROOT Inc.

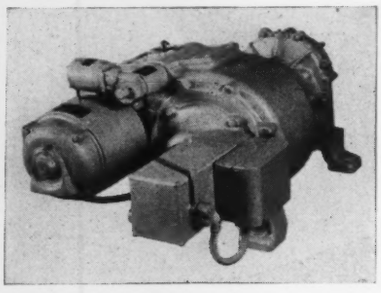
HARTFORD, CONNECTICUT, U. S. A.

OFFICES IN Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne

All features of the standard fitting are embodied by the new model, with the added advantage of the ball head integral with the fitting.

Lever Governs Variable Speed System

STERLING ELECTRIC MOTORS INC., Los Angeles, announces the 3-horsepower Speed-Trol, a completely automatic variable speed system. It has 4:1 infinite speed variation with 30:1 type B Slo-Speed gear reduction giving output shaft speeds of 60 to 15 revolutions per minute. The position of the small lever on the control box at the bottom of the illustration governs the speed of the output shaft. The lever travels through an arc of approximately 60 degrees for a complete speed range, minimum power being required to move it. Three-phase pilot motor operates the handwheel shaft and is energized by two rugged mechanically interlocked industrial contactors mounted in an ironclad box with a readily removable cover. These variable speed units can be furnished a number of ratings up to 15-horsepower, with all standard gear ratios.



Speed of output shaft of automatic variable speed system is governed by lever on control box

Electrode Welds Moly-Stainless

THE LINCOLN ELECTRIC CO., Cleveland, announces a new arc welding electrode of the 18-8 type, having 3½ per cent molybdenum. Designated Stainweld C, this electrode will weld the considerable number of stainless steels on the market which have approximately 3½ per cent molybdenum. A coating provided on the electrode prevents oxidation of the weld metal and keeps the analysis of the deposited metal virtually the same as the parent metal. Hence welds have high tensile strength and ductility and possess similar corrosion resistance qualities. In 25-pound packages, the electrode is made in three sizes: ⅛, 5/32, and 3/16-inch, and 11½-inch lengths.

Magnetic Clutch-Brake Announced

TO MEET requirements of a compact, readily accessible clutch and clutch-brake combination, adaptable particularly for flywheel or through shaft application, a new style F magnetic clutch and style FF magnetic clutch-brake combination are announced by the Stearns Magnetic Mfg. Co., Milwaukee. They can be supplied with the collector rings on the hub or

Let LEROY do your lettering!

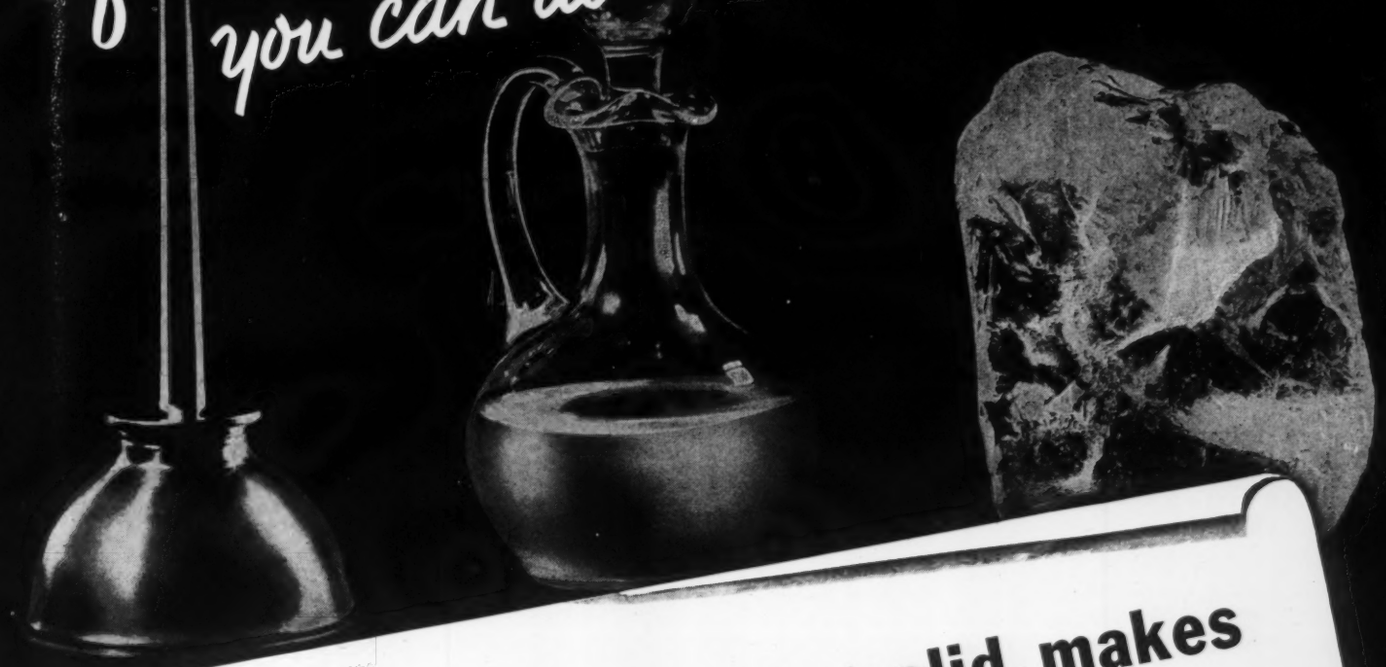
If you want your drawings lettered with unfailing uniformity, you will like this improved lettering technique.

A Leroy set consists of patented templates, a simple scriber and fool-proof, tubular pens. Complete, finished letters are formed in one operation, quickly and easily, *without shifting the template!* No guide lines, no preliminary "roughing in." Each template produces both vertical and slanting letters and numerals. All work is performed well above the line, in full view of the operator. There is no danger of smearing when the template is removed.

Add Leroy lettering to your drafting room equipment. There are templates and pens of all sizes—sold singly or in sets. Your K & E dealer will be glad to arrange a demonstration—or write us for illustrated Booklet No. 81.

K & E LEROY
REG. U.S. PAT. OFF.
LETTERING SETS

Of course, you can do it with oil, but . . .



This new synthetic solid makes a BETTER tracing paper

MINERAL OIL. Most tracing papers are treated with some kind of oil. Mineral oil is physically unstable, tends to "drift," never dries completely. Papers treated with mineral oil pick up dust, lose transparency with age.

VEGETABLE OIL, chemically unstable, oxidizes easily. Papers treated with vegetable oil become rancid and brittle, turn yellow and opaque with age.

ALBANITE is a crystal-clear synthetic solid, free from oil and wax, physically and chemically inert. Because of this new stabilized transparentizing agent, Albanene is unaffected by climate—will not oxidize, turn yellow, become brittle or lose transparency.

Three years of patient research produced this exceptional tracing paper. Albanene is made of 100% pure white rags, treated with *Albanite*—a crystal-clear synthetic solid discovered in the K & E laboratories. It is free from oil and wax—physically and chemically inert. Albanene will not oxidize, turn yellow, become brittle or lose transparency with age. Your drawings are protected against the ravages of time.

Even more to the point, Albanene has all the working qualities you've always wanted . . . a fine hard "tooth" that takes ink or pencil beautifully and erases with ease . . . a high degree of transparency that makes tracing simple and produces strong sharp blueprints . . . and extra strength to stand up under constant corrections, filing and rough handling. Because Albanene is truly permanent, *it will retain all these characteristics indefinitely!*

Try Albanene yourself, on your own drawing board. Ask your K & E dealer, or write us, for an illustrated brochure and a generous working sample.

EST. 1867

KEUFFEL & ESSER CO.

NEW YORK · HOBOKEN, N. J.

CHICAGO · ST. LOUIS · SAN FRANCISCO · DETROIT · MONTREAL

K&E Albanene

REG. U. S. PAT. OFF.

THE STABILIZED TRACING PAPER

Fig. 1645
Pat. App'd for

You have fewer chances for breakdowns on machines equipped with . . . . .

UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS with the Knurled Points

Breakdowns, caused by ordinary set screws shaking loose, can be prevented by using "Unbrako" Self-Lockers . . . and the maintenance problem reduced. The knurling around the points of "Unbrako" Self-Locking Hollow Set Screws holds them tight when tightened up in the normal way. Removal for adjustment is easy and the screws can be reused. Proven in actual service.

Fig. 1646
Pat. App. F r

UNBRAKO

SELF-LOCKING SQUARE HEAD SET SCREWS are "stay-putters" too

Wherever a square head set screw is subject to vibration, use these. They can't shake loose once tightened up, but can be removed without trouble and used over and over again.

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.
BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

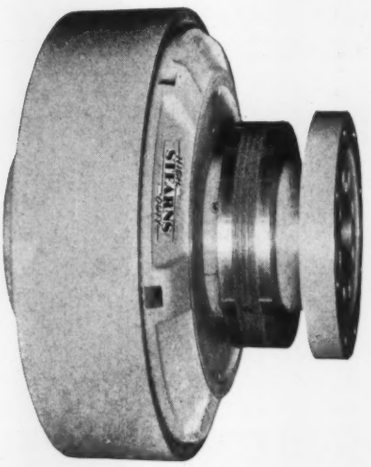
Send me samples and all the facts about

☐ "UNBRAKO" Self-Locking Hollow Set Screws.
☐ "UNBRAKO" Self-Locking Square-Head Set Screws.

Mr..... Title.....

Firm.....

Address.....



Simplicity of design of clutch-brake combination affords ready accessibility for adjustments

on the body. Simplicity of design affords ready accessibility for adjustments and lining replacement when necessary. These units are made in a variety of combinations and sizes.

Records Time of Machine Processes

FOR accurate timing of industrial processes an improved Signal-Graph has been announced by Production Instrument Co., 702 West Jackson boulevard, Chicago. The unit automatically records the processing time of each operation, as well as the loading or inactive time, on a chart calibrated in minutes. Originally designed for mechanical connection to the equipment, the improved Signal-Graph is controlled by an electrical switch and may be located at any distance from the machine. The device is operated by a synchronous motor and measures time with an alternating current clock.

Device not only accurately times industrial processes, but automatically records processing time

Develop Independent Reset Control

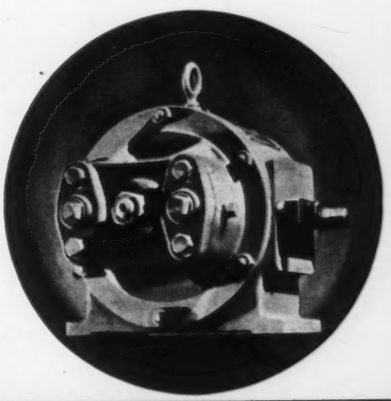
AN ENTIRELY independent reset control which may be installed on any control application by a hook-up on the diaphragm motor valve line without disturbing the control instrument is announced by the American Schaeffer & Budenberg Instrument division of Manning, Maxwell & Moore Inc., Bridgeport, Conn. This control was developed to meet the need for some

FLEXIBILITY

HELE-SHAW *Fluid Power* HAS IT!

You know how flexible spaghetti is! Well, a few strands of it will give you a good idea of the flexibility of locating a Hele-Shaw Pump . . . for this reason . . . you can mount a Hele-Shaw Pump anywhere you please—on the side, top or end of the machine you are driving, alongside it or hundreds of feet away. Fluid Power from the Hele-Shaw Pump is carried by pipes over or around any corners or obstructions. The flexibility of locating Hele-Shaw Pumps is one of many practical, usable advantages of Hele-Shaw Fluid Power well worth looking into. Ask us to show you how we can put Hele-Shaw Fluid Power to work for you.

Other A-E-CO Products: Lo-Hed Hoists, Taylor Stokers, Marine Deck Auxiliaries.

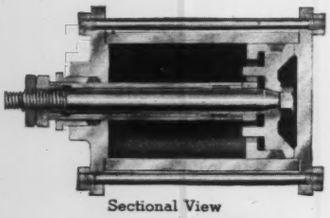


A-E-CO Hele-Shaw FLUID POWER

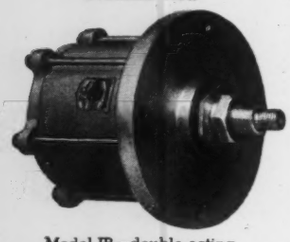
AMERICAN ENGINEERING COMPANY

2502 ARAMINGO AVENUE, PHILADELPHIA, PA.

Where can *you* use this *High Efficiency* AIR POWER?



Sectional View



Model JR—double acting air cylinder

Model BR—double acting air cylinder

Model CR—double acting air cylinder

Hannifin "Pack-Less" Air Control Valves available in all types for positive control of air operated equipment.

Hannifin Air Cylinders provide efficient power movement easily adaptable to the greatest variety of uses. Simple installation, simple controls, and maximum utilization of air power are practical advantages easily obtained. Hannifin air cylinders are *all* bored and honed, and equipped with the exclusive Hannifin outside adjustment of piston packing. Correct adjustment of the soft graphite-treated piston packing is made at any time without disturbing other parts. High efficiency operation, with minimum friction loss and no leakage, is consistently obtained.

Hannifin Air Cylinders are built in a full range of standard types, sizes 1½ to 16 inch bore, for any length stroke. Larger sizes built to order. Single and double acting types, with or without air cushion. Write for Bulletin 34-MD with complete specifications.

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Engineers · Designers · Manufacturers · Pneumatic and Hydraulic Production Tool Equipment

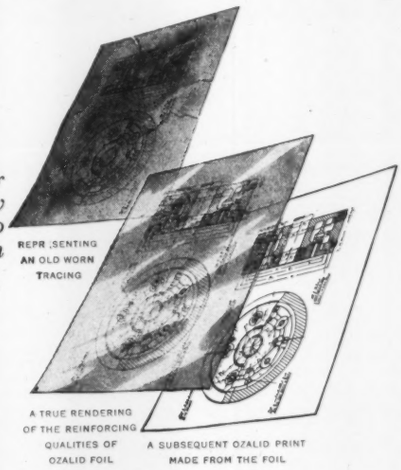
HANNIFIN
High Efficiency AIR CYLINDERS

device to compensate automatically for shifting of the control point caused by changes in the controlled process. The American Micromotor Reset automatically returns the controlled temperature or pressure to the controller set point after a load change occurs. It begins to function immediately and accomplishes the correction as rapidly as the process will permit.

Engineering Dept. Equipment

Simplifies New Foil Reproduction

TWO types of foil impregnated with Ozalid light-sensitive solution have been announced by the Ozalid Corp., 354 Fourth avenue, New York, making possible short cuts in drafting and technical reproduction. Ozalid clear foil, No. 4850, is glossy on both sides and can be used to clarify line detail and eliminate soiled and dirty background in a print made from a foil duplicate of an old and worn tracing. Shown in the illustration, this clear foil also provides a fast printing duplicate when more than one original


REPRESENTING AN OLD WORN TRACING
A TRUE RENDERING OF THE REINFORCING QUALITIES OF OZALID FOIL
A SUBSEQUENT OZALID PRINT MADE FROM THE FOIL

Application of clear foil, one of two new types introduced to enable short cuts in reproduction

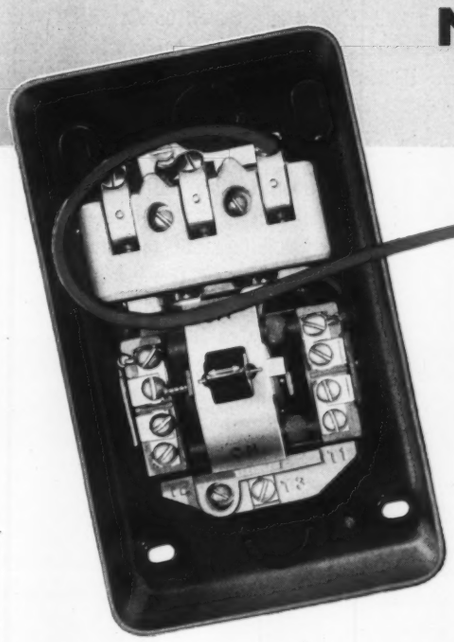
is needed. Its transparency makes possible the duplication of as many as six copies simultaneously. A new matted foil, No. 4975, is also available and widens the scope of the dry-developing process. A fundamental design, for instance, can be duplicated incorporating changes and corrections in the finished print without altering the original in any way. This is done by dropping out, either by the block-out method or by use of Ozalid corrector fluid, that portion of the design to be eliminated from the finished print. Changes are drawn on the foil, which will take pen and pencil lines.

Number of Pencil Degrees Increased

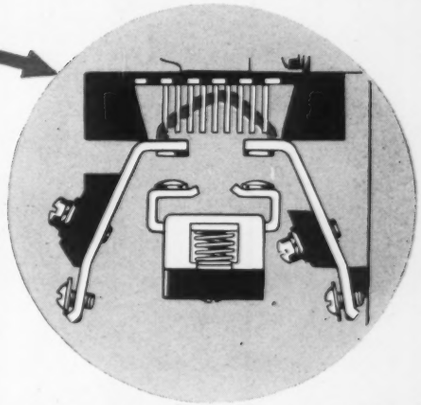
J. S. STAEDTLER INC., 53-55 Worth street, New York, has announced important increases in the number of degrees in which several of its items are now obtainable. The No. 2886 Mars Lumograph

"De-ion" Arc Quenchers

PROLONG CONTACT LIFE IN THIS NEW MANUAL STARTER



When the switch is opened, arcs are quenched instantly by "De-ion" grids. Note how the arc is drawn into the grids, cut into small pieces and extinguished.



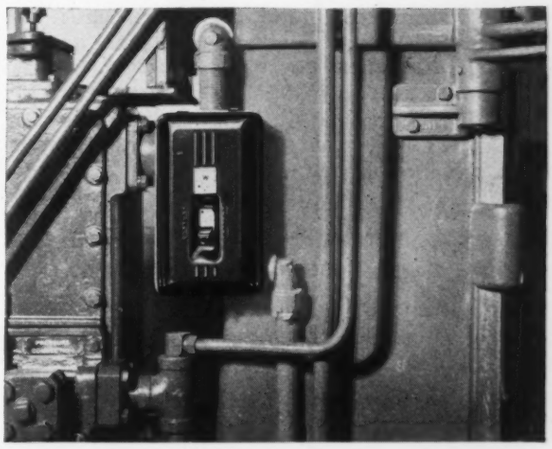
Snuffs out arcs . . . prevents flashover . . . stops burning of contact points. It's 1939's best buy for starting motors up to 7½ hp.

COMPARE with any starter at the price

- snap action bi-metal disc relay cuts the motor from the line before heat from overload can damage the windings. Resets to correct calibration.
- equipped with safety interlock — prevents accidental contact with live parts.
- indicating handle shows at a glance whether starter is on, off or tripped.

Phone your nearest Westinghouse office or distributor for prices, sizes, types and capacities.

J-20849



WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.

Westinghouse

"De-ion" Motor Watchman

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WESTINGHOUSE ELECTRIC

● 1. Save money, by using Ohio Stock Gears.
2. Save time, through prompt, speedy Ohio Gear shipments, *right out of stock.*

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Phone, write or wire Ohio Gear or the nearest representative. Your order will get prompt, *intelligent* attention.

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*San Francisco, Calif. Adam-Hill Co., 244-246 Ninth St.
Indianapolis, Ind. A. R. Young, 518 North Delaware Street.
Pittsburgh, Pa. Industrial Sales & Engineering Co., Box 8606, Wilkinsburgh, Pa.
Detroit, Mich. George P. Coulter, 332 Curtiss Building.
Buffalo, N. Y. F. E. Allen, Inc., 2665 Main Street.
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New England, George G. Pragst, 260 Esten Ave., Pawtucket, R. I.
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*Stocks carried.

OHIO GEARS

drawing pencil is now available in 19 degrees of hardness, instead of 17. The No. 1018 Mars Lumograph artists' pencils and the No. 1904 refill leads are now made in 15 degrees.

Equivalents Transfer on T-Square

ALL the usual decimal equivalents from 1/64 to 63/64 are contained in an 8 x 1¾-inch "decal" being distributed free of charge by The Frederick Post Co., Box 803, Chicago. Sized to fit the T-square, the decal is easily transferred and will eliminate squinting at distant figures on a wall chart.

New Slide Rule Appears

THE Langsner industrial slide rule, manufactured by the Eugene Dietzgen Co., Chicago, is designed to solve an unusual range of industrial problems with only one movement or setting of the slide in the majority of cases. Although there is only one slide, the Langsner combines many rules in one. The face has six scales: Two of them above the slide represent feed, length of cut, and diameter; three of them on the slide represent revolutions per minute, time and cutting speed; the regular D scale is below the slide. The reverse side of the slide contains the usual B, CI and C scales, for standard slide rule calculations. Solutions to many problems may be obtained at a glance, such as surface speeds, cutting speeds, diameters of cutters, drills, required revolutions per minute, feed ratios, length of cut, time required, etc.

Meetings and Expositions

July 10-15—

American Society of Mechanical Engineers. Semi-annual meeting to be held at Palace hotel, San Francisco. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

July 25—

American Society of Agricultural Engineers. Pacific coast section meeting to be held in San Francisco. W. W. Weir, 320 Hilgard Hall, University of California, Berkeley, Calif., is in charge of meeting.

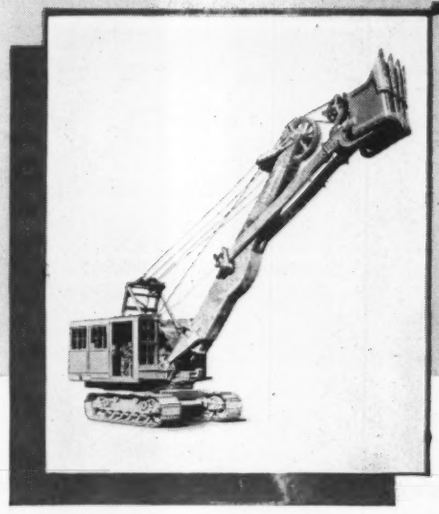
Aug. 17-19—

American Transit Engineering association. Meeting to be held in Los Angeles. Further information may be obtained from G. C. Hecker, 292 Madison avenue, New York.

Aug. 28-31—

American Mining congress. Metal mining convention and exposition to be held at Minerals building,

(*Concluded on Page* 74)



Koehring Equipment ALWAYS ON ITS "METTLE"— AMPCO METAL

ALWAYS ready to give its best efforts . . . always in the highest state of efficiency . . . Koehring's world famous line of contractors' equipment is always on its "mettle" . . . because more than a decade ago the Koehring engineers investigated the merits of AMPCO METAL. Tests indicated its wear resistance and compressive strength to be far superior to that of other bronzes tested. As a result, the Koehring Company has standardized on AMPCO METAL ever since for all highly stressed bronze parts.

Properties Found Only In Ampco Bronze

It's the *processing* that makes AMPCO a superior bronze. The "Ampco Phase" is not a mere catchword—but a unique step in the development of a better alloy. Comparative tests are convincing, and unfailingly reveal the longer wearability of AMPCO METAL—its greater resistance to shock—its greater wearability wherever stress and strain are involved.

These properties, processed into AMPCO METAL, are not found in any other bronze.

First Choice Wherever Metals Are Highly Stressed

Fortified with AMPCO METAL, the lower traction shaft bushings on Koehring shovels run against hardened steel at a speed of 17 revolutions per minute and under loads ranging from 32,000 to 46,000 pounds. Hoist drum bushings of AMPCO run against heat treated steel at 35 revolutions per minute under loads up to 22,000 pounds. AMPCO METAL is also used for bushings and idler sprockets in connection with the chain crowd mechanism . . . for saddle blocks on chain crowds . . . for spiral boom trolley base bushings . . . drum bushings . . . and boom hoist drum bushings. Turntable roller bushings of AMPCO METAL carry the whole weight of the cab, boom and load. Throughout the Koehring line, wherever a bronze must have extreme wearability under stress and strain, AMPCO METAL has had the preference for many years. Keep your equipment always on its "mettle"! Write for File 40—a bound volume of Ampco Engineering Sheets.

AMPCO METAL, INC. Dept. MD-7, Milwaukee, Wis.

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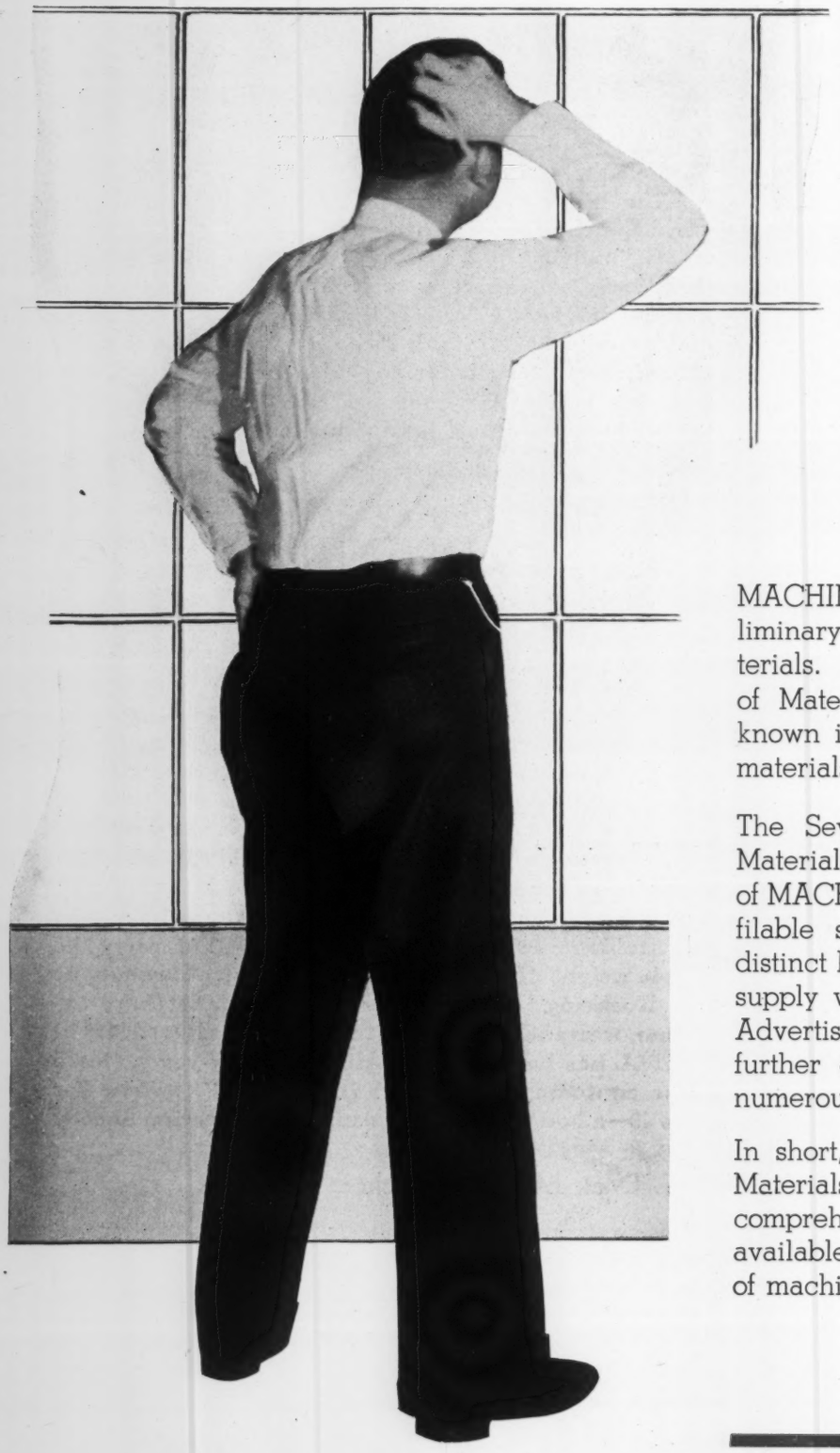
"The Metal without an Equal"

. . . distinguished by this mark.

MATERIALS are



....bu

Yes, that question and scores of others relating to the selection and use of materials in the design of machinery are forever confronting design executives, chief engineers and designers. Their proper answer may be the vital element in success of a new design.

MACHINE DESIGN has simplified the preliminary work involved in selection of materials. Six earlier editions of its Directory of Materials have helped to correlate all known information on practically all major materials used in the design of machinery.

The Seventh Edition of the Directory of Materials will accompany the October issue of MACHINE DESIGN as another removable, filable supplement. Seven separate and distinct lists of materials and their sources of supply will comprise the directory section. Advertisements of materials suppliers will further describe and explain the uses of numerous materials.

In short, the Seventh Annual Directory of Materials will be the most up-to-date and comprehensive source of materials data available for the exclusive use of designers of machinery.

EVERYWHERE

which should I use?

Practically all materials used in the design and construction of modern machinery will be covered. The following list of sections of the Directory shows its broad coverage.

1: Alloys, Ferrous and Nonferrous, by Tradenames.

2: Plastics and Nonmetallic Materials, by Tradenames.

3: Producers of Tradenamed Materials.

4: Stampings Producers.

5: Forgings Producers.

6: Die Castings Manufacturers.

7: Plastics Molders.

A copy of the Directory of Materials will be a removable, filable supplement in every issue of MACHINE DESIGN in October. Additional copies of the Directory may be secured at twenty-five cents each. To assure yourself sufficient copies for members of your staff, we suggest placing your order in advance.

Manufacturers of Alloys, Plastics and other Engineering Materials may augment their necessarily condensed listings with display space, in which application photographs and detailed descriptive matter concerning their products can be shown if desired. For further information write MACHINE DESIGN, Penton Building, 1213 West Third Street, Cleveland, Ohio.

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The Verdict
OF ENGINEERS!

"Won't jam, slip, round out or split"
"Basic as key and keyway"
"Faster, tighter, easier set-up"
"Positive acting as meshed gears"
"Cuts assembly costs"

Use BRISTO SOCKET SCREWS and cash in on these MULTIPLE SPLINE ADVANTAGES

ENGINEERS — yes, and designers, production heads, works managers—in fact, every man whose job it is to cut time, costs and effort in product assembling—all prefer Bristo's multiple spline socket head design for faster, tighter, easier socket screw set-up. And so will you!

Bristo Socket Screws are now used on such products as electric shavers, sewing machines, X-ray machines, tabulating and computing machines, stock market tickers, cameras, postage meters, scientific instruments and vending machines.

Put Bristo to the test today. Send for free samples and your copy of Bulletin 83-5N which gives complete details on these superior socket screws. No obligation. The Bristol Company, Mill Supplies Division, Waterbury, Conn.

FEATURES AT A GLANCE!

MULTIPLE SPLINE SOCKET — as positive acting as meshed gears —Won't split, shear, strip, round out, slip or jam—Sets tighter with less effort—No loosening under vibration—Takes wrench without fumbling or skidding.

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TRADE MARK REG. U.S. PAT. OFF.

Multiple Spline
SET AND CAP SCREWS

Approved by the American Standards Association and the American Society of Tool Engineers

BRISTO MAKES YOUR PRODUCT BETTER

Salt Lake City. Julian D. Conover, 309 Munsey building, Washington, is secretary.

Aug. 28—Sept. 1—

National Association of Power Engineers. Annual meeting and exhibit to be held at Indianapolis, Claypool and also Lincoln, Ind. Fred W. Raven, 176 West Adams street, Chicago, is secretary.

Sept. 4-8—

American Society of Mechanical Engineers. Joint meeting with Institution of Mechanical Engineers of Great Britain, to be held in New York. Additional information may be obtained from C. E. Davies, 29 West Thirty-ninth street, New York.

Oct. 15-19—

Master Brewers' Association of America. Annual meeting to be held in San Francisco. Additional information may be obtained from H. O. Sturm, 30 Magee avenue, Rochester, N. Y.

Oct. 15-21—

Automobile Manufacturers association. Fortieth annual national automobile show, to be held at Grand Central Palace, New York. Additional information may be obtained from headquarters at General Motors building, Detroit.

Oct. 22-27—

American Welding Society. National convention and exhibit to be held in Chicago. M. M. Kelly, 33 West Thirty-ninth street, New York, is secretary.

Oct. 23-27—

American Society for Metals. National Metal Exposition to be held in conjunction with the annual meeting of the society in the International Amphitheater, Chicago. W. H. Eisenman, 7016 Euclid avenue, Cleveland, is secretary.

Oct. 23-28—

Dairy Industries exposition to be held in San Francisco. R. Everett, 232 Madison avenue, New York, is in charge of exposition.

Injection or Compression Molding?

(*Continued from Page* 33)

on the thickness of the phenolic molded pieces except for uniformity. Phenol-aldehydic plastics may be molded several inches in thickness, though thick sections of this description will produce costly pieces by reason of the prolonged curing cycle that would be incurred. Designs should avoid the combination of very thick and very thin sections, however, inasmuch as the time of cure is determined by the thickest

...and now THE NEW DRIVE THAT PROTECTS ALL TYPES OF DRIVEN EQUIPMENT FROM DAMAGE CAUSED BY OVERLOADING

Philadelphia PLANE TORQUE MOTO REDUCER

Here is a motor drive that provides unfailing protection for agitators, mixers, conveyors or any equipment that might jam or become overloaded. The motor is shut off automatically and instantly when the load exceeds a predetermined value. As soon as the excessive load is removed, the unit is ready to start without resetting. It is not necessary to rely upon fuses, thermal overload relays or other devices for protecting equipment from damage caused by loads jamming, catching or becoming excessive. The few seconds required for such devices to function can allow untold damage to occur to expensive machinery and driving mechanism alike. PlaneTorque MotoReduceRs can be supplied for horizontal or vertical drives in all horsepowers and ratios for industrial use.

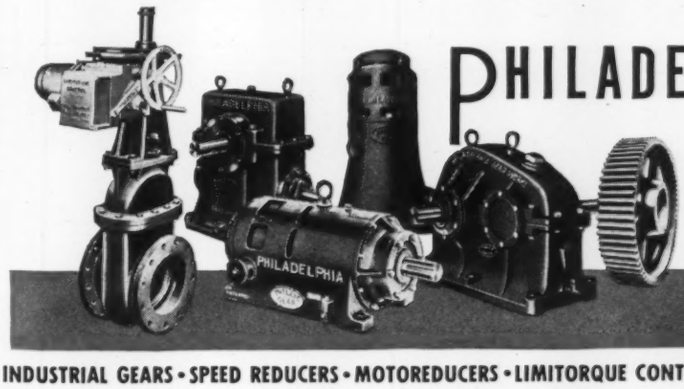
HOW IT OPERATES

Whenever excessive torque is imposed on the output shaft of the PlaneTorque MotoReduceR, the increased torque required to rotate the planet gears mounted on the output shaft Spider transmits a higher torque to the internal gear which is held in normal position by the Lug and heavy spring (see illustration).

When the torque on the internal gear exceeds a predetermined value, the torque spring is compressed. This movement of the Lug actuates the switch at the top disconnecting the power.

These units are furnished for clockwise or counter-clockwise rotation or for both if reversing service is desired.

PlaneTorque can be furnished with all Philadelphia MotoReduceRs



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INSUROK

INSUROK, the precision plastic produced by Richardson, offers designer and engineer almost limitless opportunities to use plastics for a wide variety of parts or completely finished products. INSUROK makes possible many manufacturing economies. It gives to products improved structure, appearance and performance . . . adds extra value and sales appeal.

Consult Richardson technicians about any plastics problem. No obligation, of course.

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section, which may be excessive for the thin section and cause it to be marred by overcuring. Urea-aldehydic plastics on the other hand are permitted relatively thin sections in compression molding, in the neighborhood of ⅛-inch, though designs almost ¼-inch are known. With increased thickness of section the problem of curing a urea plastic molded part thoroughly becomes more serious. Failure to mold properly will form an article poor in durability and not up to the high standards otherwise maintained by urea plastic articles.

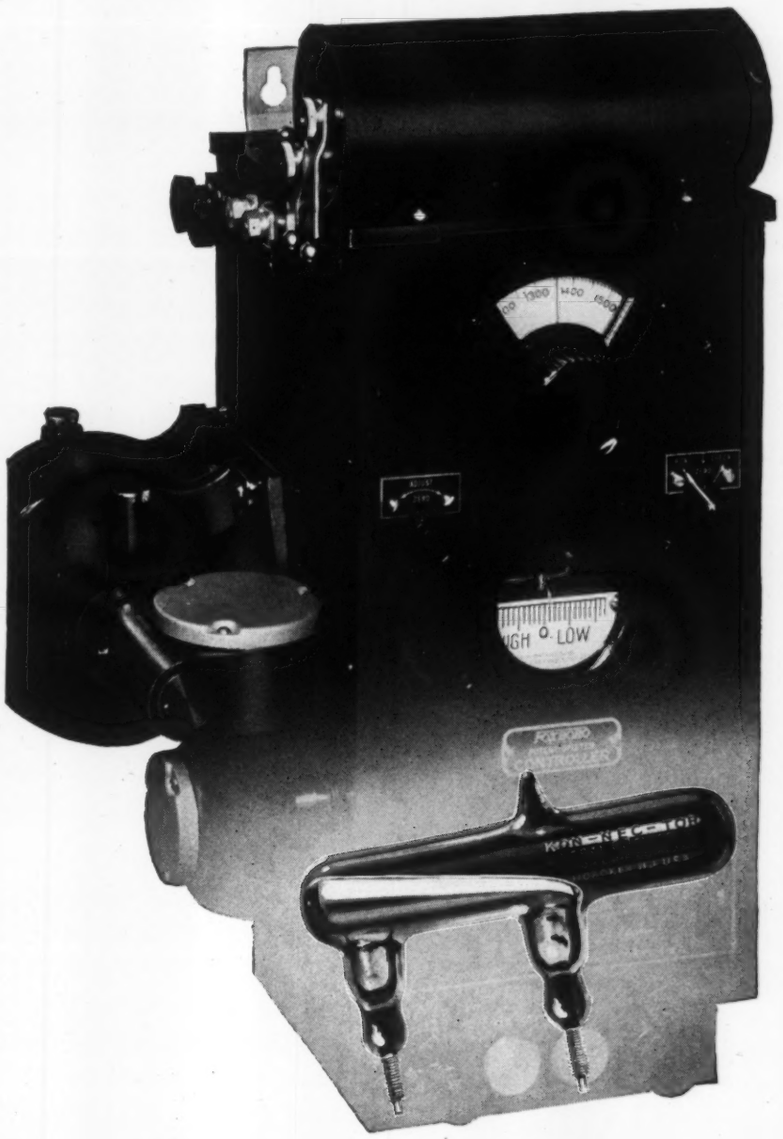
The significance of uniform wall thickness is brought out in *Fig.* 7, where the box would have an unsatisfactory design from the standpoint of molding if thick and thin wall sections were present. Usually a simple redesign as indicated through the cutout portion shown in dotted lines serves to make a suitable modification. Problems such as these are common occurrences, and the designer must ask himself not only what material is to be used, but also how the part is to be molded.

Nature of Insert Determines Method

INSERTS. Injection and transfer molding are so well adapted to the molding of plastic materials about large and complicated inserts that the nature of the insert and its relative complexity will determine the method of molding. This question may be looked at from another angle, for if the designer knows that the piece is to be produced in a transfer mold rather than a conventional semipositive mold, for example, he can overlook a number of the former precautions against horizontally placed inserts and cores. There are material limitations such as flow of the molding material under molding pressure and differences in thermal expansion between insert and plastic to contend with, but stampings, castings, and screw machine parts appear every day in newly designed parts molded of plastic materials. In the long run it will be found that there are savings to be effected through integrally designed pieces of this nature, due to savings in handling of extra pieces in the final assemblies. Methods of attachment are often eliminated in those designs in which integrally placed metal inserts are molded directly into position in the plastic. Considerations of this nature are determined solely by the mold design and the method of molding. *Fig.* 8 shows a transfer molded article with inserts.

Inserts and their effects upon the costs of molded parts often raise a question by designers when the merits of molding a piece with or without inserts is being considered. While an improper design of insert in conjunction with the molded part may cause much grief and unnecessary expense, there are some fundamental questions that should be answered. Can the piece be molded without the insert and still fulfill the original purpose economically, as satisfactorily, and with the same dependability? In the majority of cases the use of the insert in the molded part is imperative,

THE *Control* WITHIN A CONTROLLER



Only one-thousandth of an inch pointer deflection of this Foxboro potentiometer controller sets into positive action the mercury switch contacts for smooth, accurate temperature regulation – control of industrial temperatures in the making of iron, steel, glass, ceramics, chemicals. Reliable, positive control of the electrical circuit depends on KON-NEC-TOR mercury switches.

KON-NEC-TOR mercury switches are adaptable to the design requirements of electrical equipment, large or small – they are used in huge stripping shovels, in small postage meters. They are used in elevators, printing presses, ice cream cabinets. Whatever the job, wear-proof and trouble-free contacts are provided by KON-NEC-TORS.

"KON-NEC-TOR," the new catalog illustrating the different switch types, gives complete specifications, as well as valuable engineering suggestions. Write today for your copy. General Electric Vapor Lamp Company, 825 Adams Street, Hoboken, New Jersey.

KON-NEC-TORS

GENERAL ELECTRIC
VAPOR LAMP COMPANY

963K

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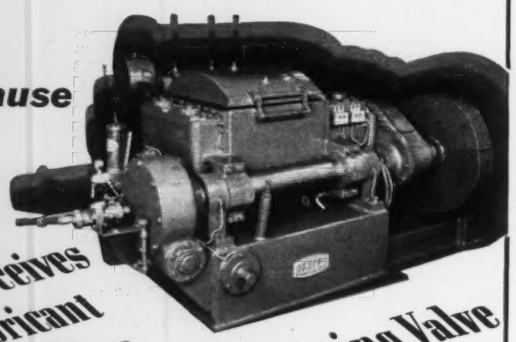
Special Delivery to Every Bearing

—Because



each receives lubricant through a Positive Farval Measuring Valve

Insure the correct lubrication of all bearings on the machines you build, by installing Farval Systems, and you will prevent bearing failures, costly shut-downs and loss of profit to your customers.

With Farval Centralized Systems, they also profit in many other ways. Farval eliminates labor of oiling. Increases production. Reduces power consumption. Saves lubricant. Reduces repair bills. Prolongs machine life.

The Farval Centralized System lubricates bearings correctly by delivering the lubricant, under high pressure, in exact, measured quantities, at proper intervals to every bearing—missing none.

A Farval Representative will help you to Engineer the Farval System best suited to the equipment you build. Write today . . . The Farval Corporation, 3265 East 80th Street, Cleveland, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Manufacturers of Automotive and Industrial Worm Gearing

FARVAL

CENTRALIZED SYSTEMS OF LUBRICATION

offering advantages not obtained by other methods. The unit cost of the molded article will rise because of increased labor on the part of the press operator in loading inserts into the mold. Then the question arises as to which method of molding is better adapted to give a low priced piece with the insert. Compression and transfer molding with manual loading of the charge may readily include placement of inserts, though compression molding is limited to the types of inserts. On the other hand injection molding with a fully automatic cycle will be impeded if inserts are added to the design, and the increase in unit cost of the molded article raised appreciably because of adoption of semiautomatic operation in place of fully automatic. Obviously, when doubt arises, consultation with molders will clear up many questions.

SIDE AND OBLIQUE HOLES. The question of side and oblique holes should be interpreted broadly to include features of a number of designs which may produce unusual undercuts on the outside surfaces. Compression molding with high pressures built up during the closing of the mold may admonish the designer against using side cores or oblique holes. Unless the design already calls for a split mold it is usually wise to avoid the expense of features which would require a split mold and increase the molding cycle. However, transfer molds are usually of the split mold variety and the introduction of one or more side holes is satisfactory. Even small coring pins unsupported for long distances are better adapted to withstand the molding material as it is flowed into the cavity as a highly mobile medium. From the standpoint of injection molding the design should not be influenced unless operations are reduced from a fully automatic to a semiautomatic cycle by the presence of a difficult side core.

Tight Molds Maintain Good Tolerances

TOLERANCES. In general, for compression molding of phenolic plastics in a positive mold, .006 to .010-inch per inch tolerance may be required for dimensions parallel to the direction of molding. The introduction of landed areas as in flash and semipositive molds improves the condition to some extent. However, good tolerances are maintained in molds that are tightly shut before the molding material is introduced, namely injection and transfer molds. This fact is important when specifying tolerances for molded parts. Other considerations are the mold construction and where the mold parting lines will be placed. Injection molding has another advantage in maintaining a good tolerance upon molded pieces, as little as .002 to .003-inch per inch in some cases, in the fact that the molds are not only clamped tightly before the material is introduced, but they are also kept cold. Inasmuch as the mold is kept close to room temperature, there is less thermal shrinkage of the molded part from mold dimensions, a problem which requires certain allowances in other mold constructions.

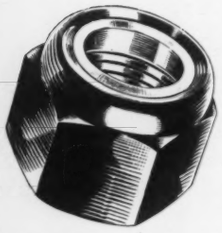
New BEARINGS FOR OLD MOTORS

Hundreds of sizes of finished bearings in stock for all general mechanical applications. Precision Machined Bearing Bronze Tubular and Solid Bars in every size required. Ask your wholesaler or write for catalog.

Speed production—cut maintenance cost—restore worn units with Bunting Electric Motor Bearings from stock. For motors of all makes 1/50 hp to 100 hp. Made of Bunting No. 72 SAE 660, the perfect bearing bronze. Completely finished ready for assembly—precision dimensions assure trouble-free installation. Any bearing, any quantity available from Bunting warehouses and distributors everywhere. Write for catalog . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

BUNTING Quality

BRONZE BUSHINGS • BEARINGS
PRECISION BRONZE BARS
BABBITT METALS



Vibration has no effect on this **SELF-LOCKING NUT**

IN bolted connections, a nut will not move as long as the thread flanges of bolt and nut are held in pressure-contact.

The problem is to maintain that pressure-contact when vibration attacks it . . . and Elastic Stop Nuts provide the solution. These nuts are cushioned . . . the locking element in each nut is composed of a resilient non-metallic material which acts as a vibration damper. Further, the locking element is integral with the nut, making its action automatic. That is why Elastic Stop Nuts hold tight on any equipment under all conditions of service.

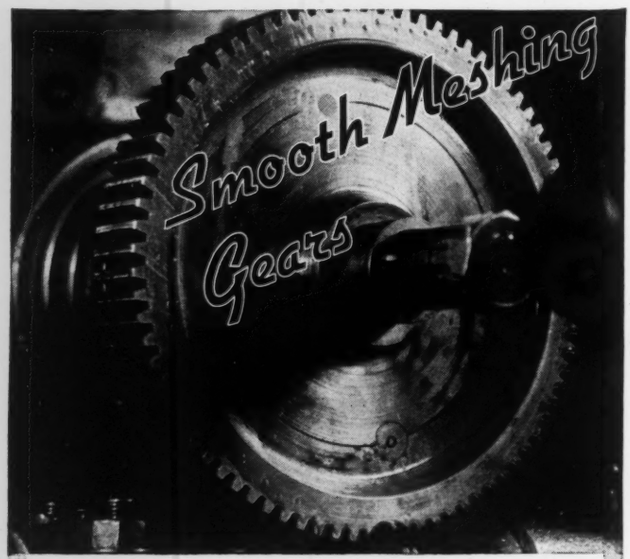
THE NUT WITH THE RESILIENT LOCKING COLLAR

SEE the Elastic Stop Nut Exhibit in the Aviation Building at the New York World's Fair.

Write for Catalog explaining the Elastic Stop principle and listing the nuts available.

ELASTIC STOP NUT CORPORATION
1011 NEWARK AVENUE • ELIZABETH, NEW JERSEY

Elastic Stop SELF-LOCKING NUTS



DESIGN—Engineered by experienced men, with many years of training in meeting the problems of GEAR manufacturing.
MATERIALS—Selected after a most careful study of the requirements of job to be done.
PLANT—Manufactured in a most completely equipped and versatile GEAR producing plant.
TYPE OF GEAR—We make all types of gears—and have had over 50 years' experience in GEAR cutting and generating.
TESTING—Our testing department is competently manned, with the latest testing devices.
RESULT—Smooth meshing gears—yet very powerful—minimizing your production problem.

D. O. JAMES MANUFACTURING COMPANY
1120 W. MONROE STREET • CHICAGO, ILLINOIS
ESTABLISHED 1888

MANUFACTURERS' *publications*

BEARINGS (BRONZE)—Johnson Bronze Co., 310 South Mill street, New Castle, Pa., has issued catalog L-1 devoted exclusively to Johnson Ledaloyl self-lubricating bearing bronze. The catalog gives salient facts about Ledaloyl and lists progressive sizes of bearings and bushings, with prices.

BEARINGS (ROLLER)—Hyatt Bearings division, General Motors Sales Corp., Harrison, N. J., has published an elaborate book on roller bearings and journal boxes for railroads. It is lavishly illustrated with action photographs and includes numerous cross-sectional diagrams. Each type of bearing or journal box is explained in detail.

BEARINGS (ROLLER)—Supplement No. 1 to the Bower Engineering Journal, previously published, has been issued by the Bower Roller Bearing Co. 3040 Hart avenue, Detroit. The supplement describes a number of new tapered roller bearing series and includes dimension sheets with load ratings.

CAST PARTS (MALLEABLE)—Four types of malleable castings produced by Belle City Malleable Iron Co. and Racine Steel Castings Co., Racine, Wis., are described in a colored folder just issued. Photographs and copy show the applications of these castings and give examples of machine parts.

CHAINS—Completely illustrated, a new catalog issued by Moline Malleable Iron Co., St. Charles, Ill., gives listings and prices of Moline malleable and combination chains and chain attachments, machine finished roller chains, and all-steel engineering type chains. Twenty-two pages are devoted to sprocket wheel listings.

CHAINS—In a four-page pamphlet, Diamond Chain & Mfg. Co., Indianapolis, shows the progress of roller chain drives, from single to 16-strands, by a series of application photographs. Title is "The Progress of Roller Chain Drives."

CONTROLS—An illustrated folder published by The Fulton Sylphon Co., Knoxville, Tenn., describes the Sylphon No. 530 diesel engine safety control which automatically shuts down the engine when water jacket temperature becomes too high or oil pressure too low.

CONTROLS (ELECTRICAL)—Automatic controls for heating, air conditioning, refrigeration and various types of industrial applications are described and illustrated in a new catalog, No. 300, published by The

(*Continued on Page* 82)

Redesign Reduces Noise

(*Concluded from Page* 44)

this character and still maintain port openings and clearances which would pass a full volume of saturated or superheated gas necessary for normal efficiency.

The new designs have resulted in a pronounced decrease in physical size. For example, the ten-ton eight-cylinder unit requires a floor space of less than eight square feet and a gross volume of 20 cubic feet as contrasted with a floor area of thirteen square feet and a volume of 40 cubic feet on the previous twin-cylinder models.

Also, the design results in a better balanced physical appearance. The lower, high-speed compressors are approximately the same size as the motor, as contrasted with the unbalanced, towering compressor which previously was as much as twice the height of the motor.

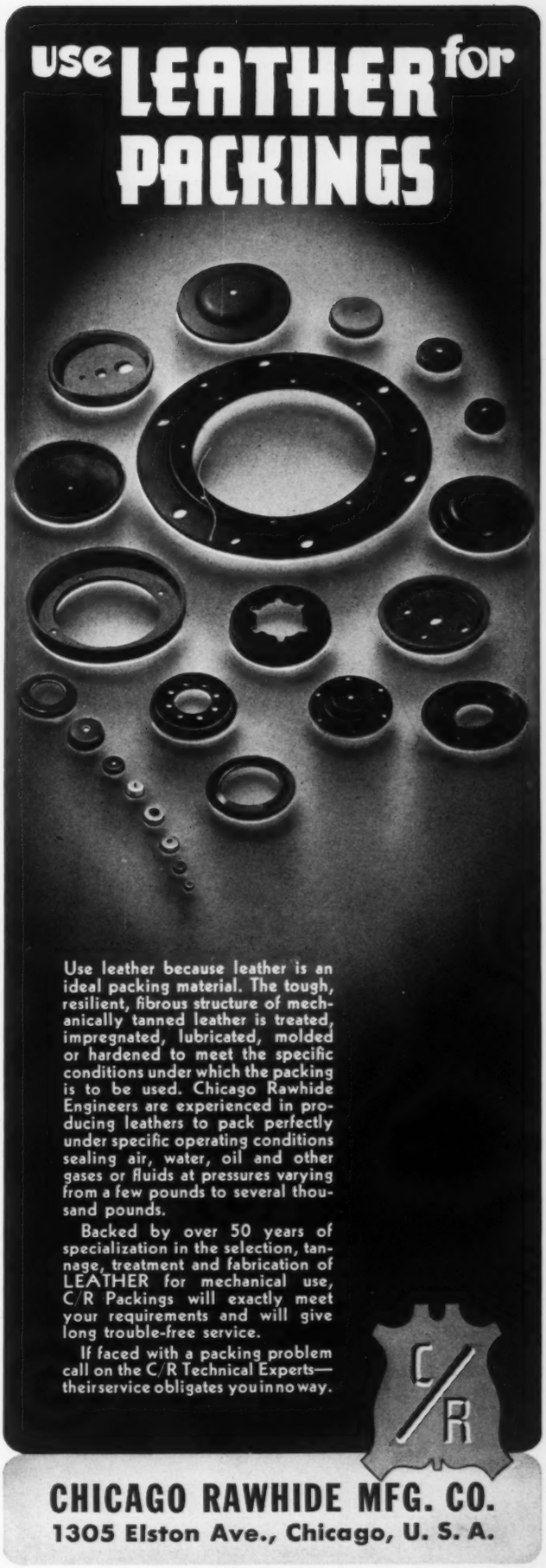
Manufacturing costs of the new units are about the same as previous "low-speed" units. Savings in weight of raw materials are offset by the increased costs of maintaining closer limits and in the use of higher grade materials. Lighter weight, of course, reduces the costs of transportation and installation. The substitution of higher grade bearing materials and forced lubrication has unquestionably extended the useful life of these new units to at least double that of the "low-speed" units available in the earlier designs.

Which Motor Fits?

(*Concluded from Page* 38)

used. If, under the same conditions, the ratio of time on to time off is less than 1:2 and more than 1:4, and if the motor cannot be operated uninterruptedly more than 30 minutes out of each 90, a ½-hour rating can be used. If the ratio of time on to time off is greater than 1:2 or if the motor can be operated more than 30 minutes uninterruptedly, a one-hour rating should be used for applications of this type.

The time rating determination applies to alternating-current motors and to constant speed direct-current motors. Since adjustable speed direct-current motors are not standard in ratings less than 1 hour, the ½ and ¼ hour ratings cannot be used for these. The advantages of smaller size and lower cost which go with these motors usually is worth while only in direct-current motors, alternating-current high starting torque and high slip motors, and alternating-current totally enclosed motors which are of the non-ventilated type.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Use leather because leather is an ideal packing material. The tough, resilient, fibrous structure of mechanically tanned leather is treated, impregnated, lubricated, molded or hardened to meet the specific conditions under which the packing is to be used. Chicago Rawhide Engineers are experienced in producing leathers to pack perfectly under specific operating conditions sealing air, water, oil and other gases or fluids at pressures varying from a few pounds to several thousand pounds.
Backed by over 50 years of specialization in the selection, tannage, treatment and fabrication of LEATHER for mechanical use, C/R Packings will exactly meet your requirements and will give long trouble-free service.
If faced with a packing problem call on the C/R Technical Experts—their service obligates you in no way.
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No. 3DB .... *Another New*

Timken Bearings

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Bronze Worm Gears

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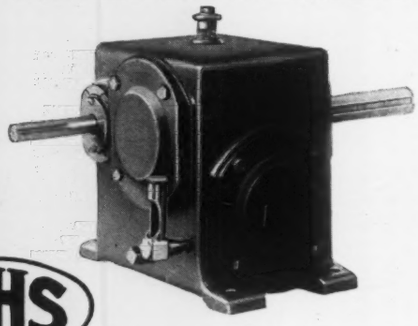


WHS

SPEED REDUCER

Adding another improved, compact unit to a line that covers the range from ¼ to 75 H.P. . . . ratios from 2-1 to 20,000-1. Leaders in the field . . . economical in first cost and long operation . . . WHS Speed Reducers are the result of nearly 40 years of specializing in the manufacture of speed reduction units.

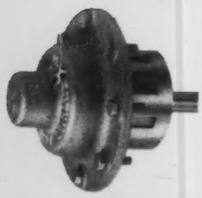
Send for Catalog

WINFIELD H. SMITH, Inc.

A Speed Reducer for Every Application

16 ELTON STREET, SPRINGVILLE, ERIE COUNTY, N.Y.

MEANS BUSINESS



Tuthill "Stripped" Pumps mean business for you in two ways. They enable you to save space and money and improve the appearance of your equipment by building the pumps directly into the design of your machine. Their ruggedness and dependability keep them on the job year after year. Types and sizes available to meet all your requirements up to 50 g. p. m. Write for "Stripped" Pump Bulletin today.

TUTHILL PUMP COMPANY

941 EAST 95TH STREET, CHICAGO, ILLINOIS

(*Continued from Page* 80)

Mercoid Corp., 4201 Belmont avenue, Chicago. Controls are grouped by types, and for each there are specifications and prices.

COUPLINGS (FLEXIBLE)—Morse Chain Co., Ithaca, N. Y., has just issued bulletin No. 57 containing complete engineering data, recommended applications, and installation information for the Morse flexible coupling line, including silent chain couplings, roller chain couplings, Morflex couplings and universal drive shafts.

DRIVES—Largest and most comprehensive in the company's history, general catalog No. 800 has been issued by Link-Belt Co., Chicago. It gives list prices, dimensions, weights, and engineering data on power transmission machinery and on equipment for handling, screening, drying, cooling, preparing materials mechanically. The power transmission section comprises 417 pages with 376 pages on chains and sprocket wheels. Requests on company letterheads should be made direct to the Link-Belt company.

ENAMELS—Maas & Waldstein Co., 438 Riverside avenue, Newark, N. J., has issued a booklet describing its Duart wrinkle enamels, giving characteristics, suggestions for using, and other information. Included is a reprint of an article on wrinkle finishes by G. Klinkenstein, vice president and technical director, which give further application information.

FASTENINGS—Spring Washer Industry, 759 North Milwaukee street, Milwaukee, has issued No. 1 of its new series of technical bulletins discussing the action of spring washers and their application.

GEARS—Characteristics and advantages of heat treated hardened gears are outlined in a new 16-page booklet, technical data 71,000, issued by Westinghouse Electric & Mfg. Co., East Pittsburgh. This booklet describes the Westinghouse-Nuttall method of treatment, control and quenching; compares properties of different materials; defines heat treatment and case hardening, and illustrates these discussions with tables, charts and reproductions of photomicrographs.

GENERATORS—Janette Mfg. Co., 556 West Monroe street, Chicago, has published bulletins 12-25 and 14-25, describing its alternating and direct current generators and dynamotors, respectively. Full details of the units are given, such as features of windings, commutators, armatures, brushes, etc.

HEATERS—A bulletin, GES-2203, just published by General Electric Co., Schenectady, shows application photographs of various machines with four types of built-in heaters—Calrod immersion heater, special Calrod heater, cartridge units, and strip heaters. A chart shows the type of heater used on different machines.

HYDRAULIC EQUIPMENT—Finger-tip pressure control for hydraulic presses is explained in a new bulletin, No. 47, issued by Hannifin Mfg. Co., 621 South Kolmar avenue, Chicago. This type of control may

be applied to straightening, hydraulic arbor, and other types of hydraulic forcing presses.

IRON (ALLOY)—Section V of the book, "Molybdenum in Cast Iron" has been published by Climax Molybdenum Co., 500 Fifth avenue, New York. This section contains data on the use of molybdenum in high strength irons, and its effect on the properties of cast iron in heavy sections.

LIGHTING—Built-in lights for machines are described in a four-page folder in color issued by Vimco Mfg. Co. Inc., 109 Chenango street, Buffalo, N. Y. Application photographs show typical installation on many machines.

MOTORS—Catalog No. J-239 has been published by the Ideal Commutator Dresser Co., Sycamore, Ill., giving complete information on all Ideal products, including motors, variable speed transmissions and electrical specialties. On page 64 begins a lengthy section on commutator care, with instructions for correcting troubles.

PLASTIC MOLDINGS—A broad array of colorful plastic pulls, knobs and handles is shown in a new 4-page bulletin, No. K-100, issued by The Imperial Molded Products Corp., 2925 West Harrison street, Chicago. All the parts are available from stock molds. Overall and center-to-center dimensions and insert specifications are given for each part.

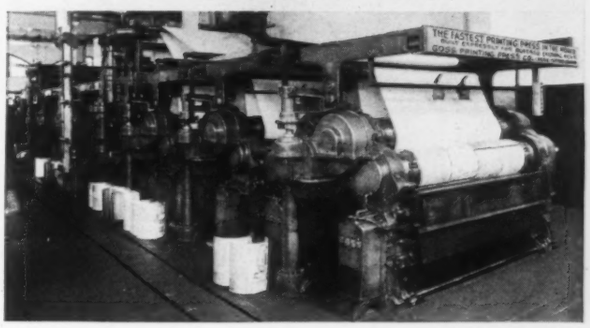
PUMPS—Seven sizes of the 1-H series of Warco-Benedek variable delivery radial pumps are described in an illustrated bulletin issued by the W. A. Riddell Corp., Bucyrus, O. Construction details and general characteristics are explained, and dimensions and capacities given. Cross sectional diagrams and photographs of parts build out the bulletin.

RUBBER—The B. F. Goodrich Co., Akron, O., has prepared a limited edition of a special 25-page handbook entitled "Rubber As an Engineering Material" which covers such subjects as properties of rubber, forms of manufacture, methods of testing, resistance to heat, corrosion, abrasion, impact, cutting and tearing. Copies are restricted, and requests must be made on company letterheads.

SHIMS (LAMINATED)—A comprehensive survey of proved applications for laminated shims or shim stock is provided in an interesting chart issued by the Laminated Shim Co. Inc., 21-86 Forty-fourth avenue, Long Island City, N. Y. Applications are arranged for easy reference, and generous illustration of installation methods adds value as a handy guide.

TRANSFORMERS—Variac auto transformers, consisting of a single winding on a toroidally-shaped core, are described and illustrated in a colored folder just printed by General Radio Co., Cambridge, Mass. Output voltages are continuously variable with perfect smoothness. Specifications of many types are given, as well as list prices.

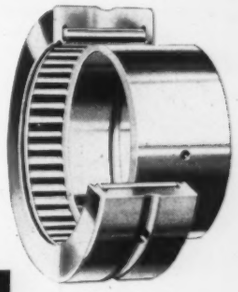
McGILL
Bearings
for Speed
Accuracy *and*
Endurance

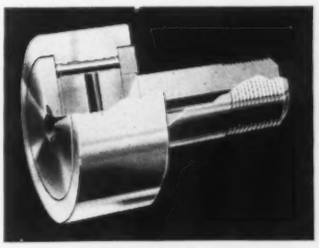


McGILL Bearings are used in this Goss Anti-friction Newspaper Press illustrated above—The Fastest Printing Press in the World. These bearings measure up to the speed requirements, accuracy, and endurance, demanded in present-day machines. McGILL *MULTIROL* Bearings are adaptable to a wide range of applications and have proved their ability to far outrun plain bearings, and frequently other anti-friction types. They will reduce bearing wear and replacements to the minimum in the equipment you build.

The small overall size of the *MULTIROL* often makes it interchangeable dimensionally with existing bronze or babbitt bearings, and, with the Cam Follower Roller Bearing, is carried in a wide range of standard sizes. Special designs can be made to your specifications.

The perfection of the McGILL "Solidend" *MULTIROL* Bearing is a great advance in needle roller bearing construction. 12% greater load-carrying capacity, simplicity of construction, rigidity, and effective sealing are secured, all at a saving in cost to the user.

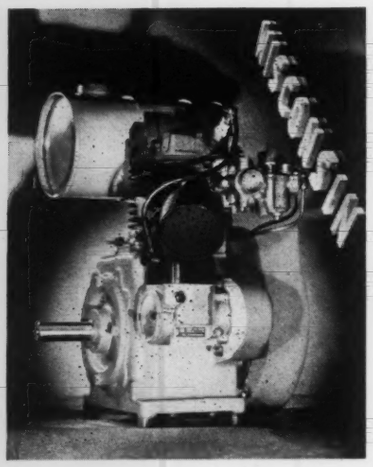




McGILL Cam Follower Roller Bearings are used in a wide range of equipment; and the advantage of these bearings is that they take greater loads than plain bearings and without appreciable wear, thus giving long, trouble-free life.

Write for Bulletin No. 37

McGILL MANUFACTURING CO.
1450 N. Lafayette Street
VALPARAISO, INDIANA



A reproduction of AB—2 H. P. Single Cyl. Engine.

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10 sizes—1 to 30 H.P.
1200 to 2400 R. P. M.

WISCONSIN BUILDS ONLY HEAVY-DUTY ENGINES

Our engineers therefore think only along the lines of "hard usage." That is why Wisconsin engines are known the world over for their long life and dependability.

HEAVY DUTY AIR COOLED ENGINES by WISCONSIN MOTOR CORPORATION

WISCONSIN
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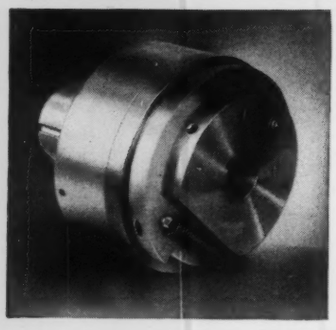
HILLIARD CLUTCHES



THE HILLIARD SINGLE REVOLUTION CLUTCH

This is an automatic clutch for intermittent and positive drive. It is especially valuable for cutting or punching operations, packaging machinery and similar applications where extremely accurate control is necessary.

Actuated by a simple trip, the Hilliard Single Revolution Clutch is suitable for mechanical, electrical or manual control. It can be set to operate on each revolution if desired or to run any number of revolutions between engagement or release.

Write for booklet giving complete information

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THE HILLIARD CORPORATION
103 WEST 4TH ST. ELMIRA, N. Y.
CHICAGO OFFICE: 201 N. WELLS STREET

Business and Sales Briefs

BROADENING its line of modern power transmission equipment, the Link-Belt Co. has been appointed distributor for the Twin Disc Clutch Co. line of friction clutches and clutch couplings in all industrial fields.

•

New distributors of the Alemite division of Stewart-Warner Corp. have recently been appointed. These are: C. A. Fine for Southern California; and E. A. Perkins and F. T. Adams, for Buffalo. Joseph C. Elliff, who recently resigned as western manager of the Saturday Evening Post, has joined the company in an executive sales capacity, working out of the office of the vice president and general sales manager.

•

In his new assignment with Westinghouse Electric & Mfg. Co., Herbert H. Rogge becomes manager of the company's agency sales department. Mr. Rogge was formerly manager of the syndicate division of the International company.

•

At the recent meeting of the Society of the Plastics Industry, the following officers were elected: Donald Dew, Diemolding Corp., Canastota, N. Y., president; Henry J. Kasch, Kurz-Kasch Inc., Dayton, O., vice president; and William S. Grove, American Insulator Co., New Freedom, Pa., secretary-treasurer.

•

Alemite Die Casting Co., Woodstock, Ill., is building a plant addition due to need of additional manufacturing space.

•

Transfer of its Detroit offices from 1010 Stephenson building to larger quarters at 1847 Bethune street, west, has recently been made by the American Screw Co., Providence, R. I.

•

Formerly engineer with Bunting Brass & Bronze Co., Robert G. N. Evans has opened a consulting office in Milwaukee. The service offered will be particularly devoted to bearing design.

•

Ajax Flexible Coupling Co., Westfield, N. Y., has appointed the Chicago Pulley & Shafting Co., 17 North Desplaines street, Chicago, as distributor of the company's line of flexible couplings.

•

Factory and offices of Belmont Molded Plastics Inc.,

Model No. 11020A

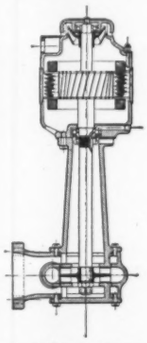
BEAUTIFY YOUR MACHINES

CHANGE TO

THE GUSHER COOLANT PUMP

Ruthman Gushers will *really* beautify your machines. They're the last word in modern design!

But that's only a minor point. Gushers are noiseless, are easily attached and have split-second control. Gushers are self-cleaning, eliminate external piping, are hydrostatically balanced and will handle materials that contain grit and abrasives. They're ball-bearing and simple in construction. They're all that you expect of the finest pumps.



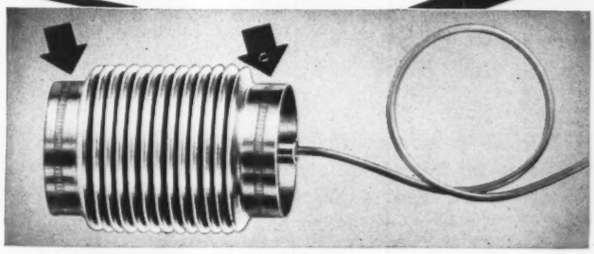
Model No. 11022
Patented and
Patents Pending

FOLLOW THE TREND—
USE "GUSHERS"

Write for Engineering Specifications

THE RUTHMAN MACHINERY CO.
540 E. FRONT ST. CINCINNATI, OHIO

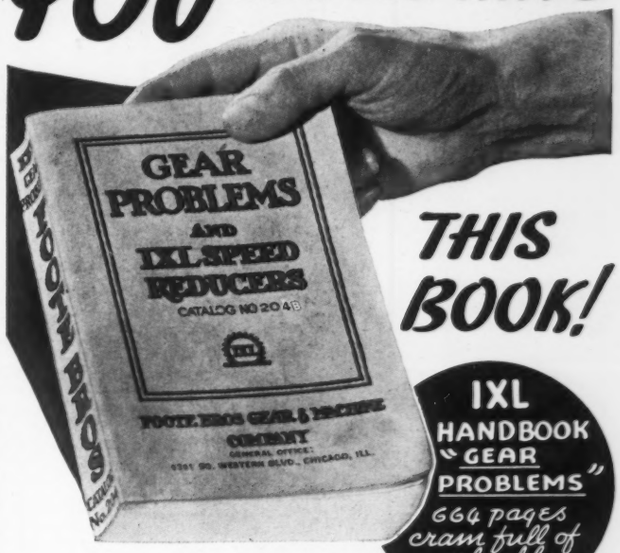
ELECTRIC RESISTANCE *Circumference* SEAM WELDING OF STAINLESS STEEL BELLOWS *to* STAINLESS STEEL END FITTINGS



Completely sealed vacuum tight stainless steel bellows units, free from soldered, brazed, or torch-welded joints, are now available to meet conditions of elevated temperatures and actively corrosive media, where use of even silver solder is precluded. Metal end fittings and end seals are attached to metallic tubing by a recently developed method of electric resistance, circumference seam welding. Specialized welding equipment operates automatically, eliminating possibility of error due to human element present in other methods. Extremely thin gauges of metal can be handled. Metals of unlike thicknesses or unlike analyses can readily be joined. Send us details of *your* problems.

CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILL. (Chicago suburb)

YOU SHOULD HAVE THIS BOOK!



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FREE to Engineers Designers, Executives

IT'S an indispensable guide for those interested in any gearing problem—it has page after page of data, tables and formulae useful in almost any phrase of engineering. It's yours—free. Just fill out and mail the convenient coupon below.

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There is a complete line of IXL speed reducers, powered gears, special drives and gears of all kinds to fit your requirements. Find out about them!

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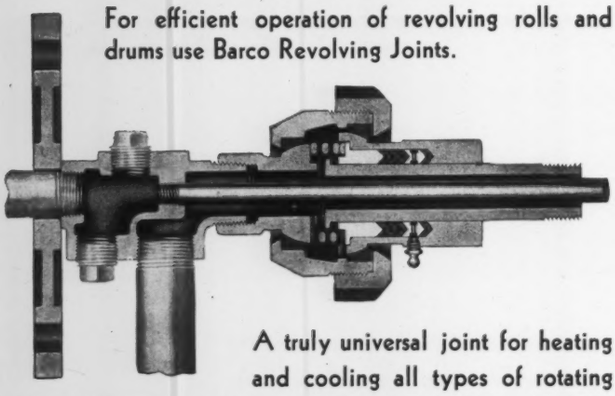
REVOLVING JOINTS

For efficient operation of revolving rolls and drums use Barco Revolving Joints.



A truly universal joint for heating and cooling all types of rotating rolls. Eliminates packing troubles due to strains in ordinary stuffing boxes.

Barco Manufacturing Co.
1820 Winnemac Avenue
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In Canada: The Holden Co., Ltd.

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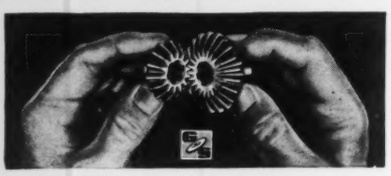
MITRES-BEVELS 10 to 48 D.P. under 6" P.D.



The very latest development in Small Bevel Gear Generating machines are at your disposal here to make such Gears *right* in every particular . . . What are your requirements?

ALSO
SPURS—SPIRALS—WORM GEARING

Made to order only No stock No catalog

Gear Specialties
INCORPORATED
CHICAGO

2670 W. MEDILL AVE. Phone Humboldt 3482

Cincinnati, custom molders of plastics, have been moved to new quarters in the Pugh building, 400 Pike street.

♦

The New York office of Tennessee Eastman Corp. has been moved to Suite 3600, 10 East Fortieth street. William L. Searles, John P. Tokarz and John H. Deer are the company's sales representatives in that territory.

♦

The Dover, N. J., plant and executive offices of The Resistoflex Corp., formerly in New York city, have been removed to Belleville, N. J., where the first completed unit of the company's new manufacturing plant is located. The new plant will house the main offices and laboratories, and will provide more adequate production facilities.

♦

Marshall L. Havey has been made a vice president of the New Jersey Zinc Co. and its subsidiaries. Ralph M. Neumann, who has been named general sales manager, will also continue as manager of the pigment division of the sales company. Arthur E. Mervine has been made assistant general sales manager, and will act also as manager of the metal division of the sales company.

♦

Appointment of Roger C. Jones as representative for Philadelphia Gear Works in the lower New England territory has been announced recently by the company. Headquarters will be in Hartford, Conn.

♦

After thirty years' association with Celluloid Corp., George H. Boehmer has retired from his position as general sales manager of the company. Edward W. Ward, for the past two and one-half years assistant general sales manager, will succeed Mr. Boehmer.

♦

With headquarters in Cleveland, C. E. Barner has joined the Wright Mfg. division of American Chain & Cable Co. Inc., Bridgeport, Conn., as district sales manager.

♦

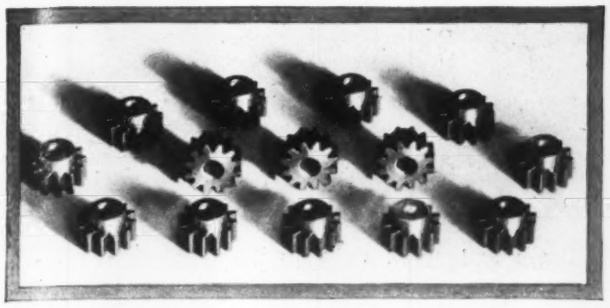
Plastic Inlays Inc., Summit, N. J., has announced the following changes in personnel: B. E. Wilson, in charge of its Detroit office, I. P. Scott, as sales representative, and Thomas Wainman as chief service engineer. The new sales manager of the company is William B. Greenlaw.

♦

Richard Rimbach, formerly director of research of Standard Steel Car Co., has been named technical advisor to R. C. Enos, president, Standard Steel Spring Co., Coraopolis, Pa.

♦

Chicago office of Maas & Waldstein Co. has been moved to 1658 Carroll avenue of that city. The new building houses both office and warehouse, and pro-



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A GROUP of small pinions cut to length from steel rod. Difficult to do without leaving burrs—but no burrs! This is because "Peck Service" is a blend of experience, care and metal, rather than just shop routine. If *your* work is a bit fussy, send it along. That's the kind we do best. And, to get better acquainted, let us send you the

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—a useful book on screw machine parts and springs, written largely from the designer's point of view. Please write on company letterhead. Thanks.

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AND SCREW MACHINE PARTS

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When you put a Roper Pump in a tough spot, how does it handle the job? In a breeze! Takes it in stride, and produces in a big way!

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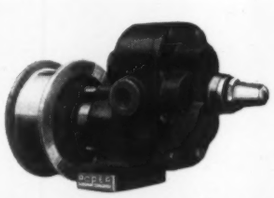
Roper Coolant Pumps are smooth performers when applied to machine tools . . . they throw a heavy stream, free from pulsation, with sufficient force to reach the deepest cuts and bores . . . they do not lose prime . . . work efficiently against high or low pressures.



WRITE FOR BULLETIN R4MD

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Coolant PUMPS

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ARE YOU LOOKING FOR A WAY TO REDUCE FLANGE SIZES?

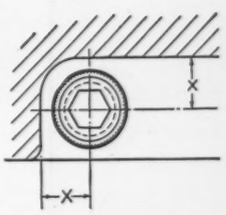
KNURLED

UNBRAKO

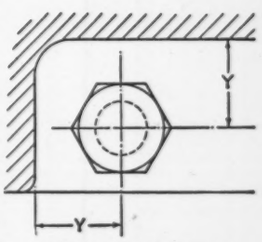
SOCKET HEAD CAP SCREWS LET YOU DO IT

Fig. 1434
Pats. Pend.

Here's how it's done!



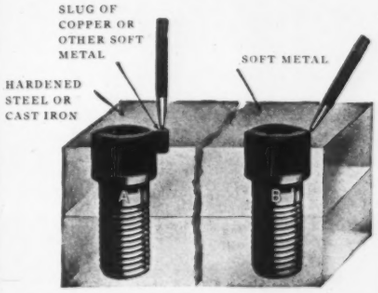
See how the Knurled "Unbrako" snuggles right into the corner.



Notice the great open spaces necessary for the hex head and wrench.

Decided savings are possible in clearance, material, weight and cost. Notice in the plan views at the right how the Knurled "Unbrako" makes these savings possible. Compare the clearance required around the ordinary hex screws (which must be set back considerably to allow for hex head and wrench) with the way the Knurled "Unbrako" will fit close into the corner. And, remember, holding power is increased as the screw head is brought closer to the joint.

Another Feature - - - LOCKS EASILY



. . . by two simple, effective methods.

When the screw is inserted in hardened metal, the soft metal slug (as shown by "A" in the illustration) locks it securely by being spread into the knurls of the screw with the aid of a locking tool. And—in soft metal, illustration "B" shows the easy way of locking.

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vides extra space required by the company's business in the mid-western territory.

♦

W. E. Gardner succeeds W. P. Knecht as manager of the Boston branch, 135 Binney street, Cambridge, Mass., of the Crucible Steel Co. of America, 405 Lexington avenue, New York. Mr. Knecht has been appointed manager of the London, England office.

♦

C. W. Franz has been added to the sales staff of Acheson Colloids Corp., 2150 Washington avenue, Port Huron, Mich., and will devote himself to sales development work in Illinois territory from his headquarters at 330 North Michigan avenue, Chicago. Mr. Franz succeeds T. P. Hunt.

♦

William A. Waldie has been appointed technical research director of New Wrinkle Inc., Dayton, O. Mr. Waldie in his new position will render service to both licensees and users of Wrinkle finishes.

♦

A member of the Waukesha Motor Co. sales staff for the past three years, Frank W. Doyle has been transferred to the West Coast branch to take up activities immediately.

♦

Modernization of its Boston plant and the addition of over 30 per cent to its storage facilities has recently been completed by Joseph T. Ryerson & Son Inc., Chicago.

♦

Sales, service and installation of the Korfund Co. Inc. line of products will be handled exclusively in the Western Pennsylvania territory by Dravo Corp., Pittsburgh.

♦

Gears and speed reducers manufactured by Ohio Gear Co., Cleveland, will be handled through St. Louis Tool Co., new sales representative in that territory.

♦

Change of the firm name of Fredericksen Co. to Saginaw Bearing Co. has recently been announced.

♦

Assistant to vice president since 1935, J. Frederick Wiese has been appointed general manager of sales of the Lukens Steel Co., Coatesville, Pa.

♦

Having started with Jones & Laughlin Steel Corp., Pittsburgh, in 1923, C. F. Goldcamp has now been appointed manager of sales of the cold finished department.

♦

Consolidation of all manufacturing facilities formerly located in Cleveland, Detroit and Stamford, Conn., in Detroit, has recently been announced by the Carboloy Co. Inc.

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The correct oil film to each individual bearing... automatically
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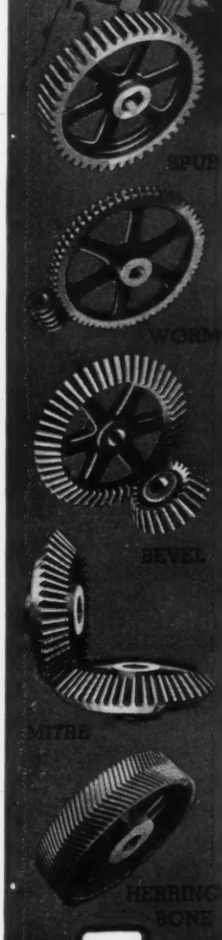

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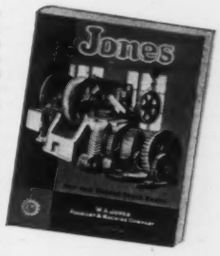

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Business

Electric dictating machine, Miles Reproducer Co. Inc., New York.
Barber chair, Theo. A. Kochs Co., Chicago.

Confectionery

Ice cream vending transport, Cycle Transport Co., Chicago.

Diesel

Engine, National Motor Bearing Co. Inc., Oakland, Calif.

Domestic

Electric clocks, General Electric Co., Bridgeport, Conn.
Portable electric ironer, Victor Electric Products Inc., Cincinnati.
Electric ranges, General Electric Co., Cleveland.

Electrical

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Precision boring machine, Stokerunit Corp., Milwaukee.
Turning and grinding machine, Lempco Products, Inc., Bedford, O.
Sheet grinding and polishing machine, Mattison Machine Works, Rockford, Ill.
Heavy-duty hydraulic grinders, Hill Clutch Machine & Foundry Co., Cleveland.
Drilling machines, Production Machine Co., Greenfield, Mass.
Lathe, Lewis Foundry & Machine Div., Pittsburgh.
High speed, hydraulic press, Chas. F. Elmes Engrg. Works, Chicago.
Hydraulic forming and stamping press, French Oil Mill Machy. Co., Piqua, O.
Double action hydraulic press, Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Internal honing machine, The Barnes Drill Co., Rockford, Ill.

Packaging

Automatic wrapper, Gellman Mfg. Co., Rock Island, Ill.
Sheet piler, Chas. Beck Machine Co., Philadelphia.
Semiautomatic vacuum bottle filler, Ertel Engineering Co., New York.
Semiautomatic labeler, Harvey Machine Co., Los Angeles.

Plastic

Mica undercutting machine, Hullhorst Micro Tool Co., Toledo.

Printing

Master former, Sta-Hi Corp., Los Angeles.

Radio

Television set, Andrea Radio Corp., Woodside, L. I., N. Y.
Antennaless receivers, and radios, Emerson Radio & Phonograph Corp., New York.

Woodworking

Belt sander, Skilsaw Inc., Chicago.
Electric sander, Detroit Surfacing Machine Co., Detroit.
Lightweight edger, Porter-Cable Machine Co., Syracuse, N. Y.
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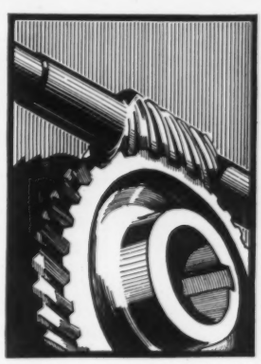

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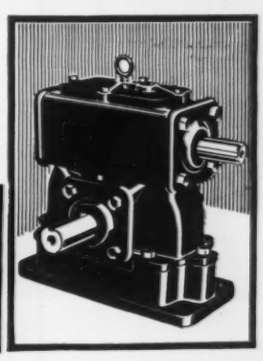

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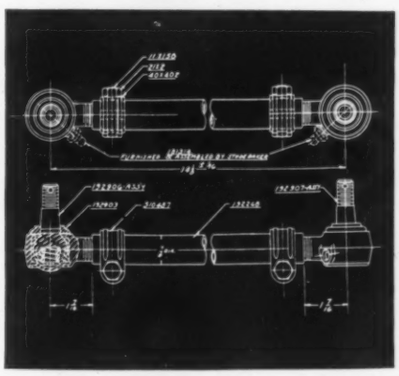
But this motorist was inquisitive. You see, he was a designer of automotive parts. "Why," he asked himself, "shouldn't a simple little seal like that last practically forever?"

So next day this engineer set about



designing a new type of seal; and after experimenting with a good many different materials he finally decided on neoprene, Du Pont's chloroprene rubber. Neoprene, he found, was oil and grease resistant, so the lubricant wouldn't rot it. It was resilient enough to adjust itself even to tiny irregularities in the surface being sealed, and to move freely without cracking. It was resistant to aging. It was, in short, the ideal sealing material where oil and grease were factors.

The Studebaker Corporation was quick to adopt this alert designer's new idea for a *permanent* tie rod seal. And this helps account for the easy steering that Studebaker owners now enjoy throughout the life of their cars.

. . . Which illustrates still another practical, profitable use of Du Pont neoprene. Keep informed of new uses for this remarkable material by reading the newsy monthly *Neoprene Notebook.* Write for free subscription.

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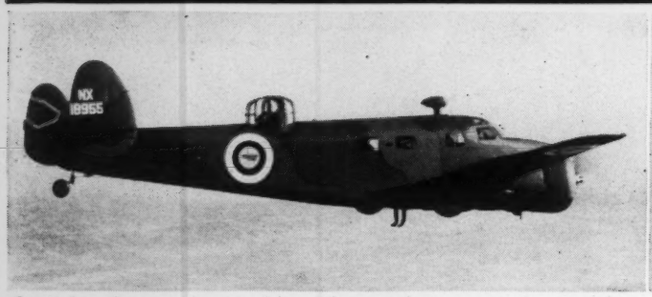
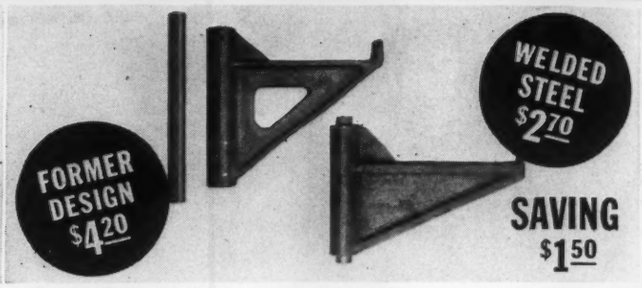
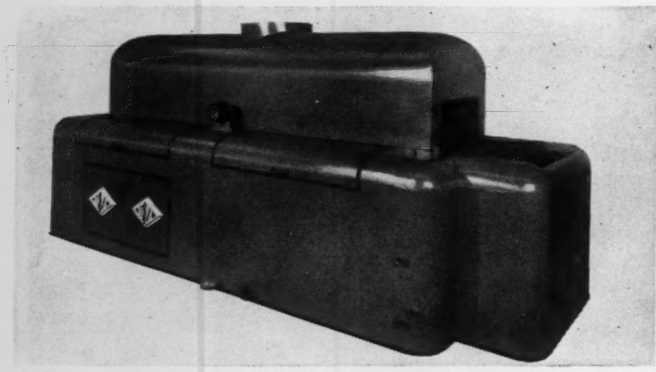
DID YOU KNOW THIS *About Welded Design?*



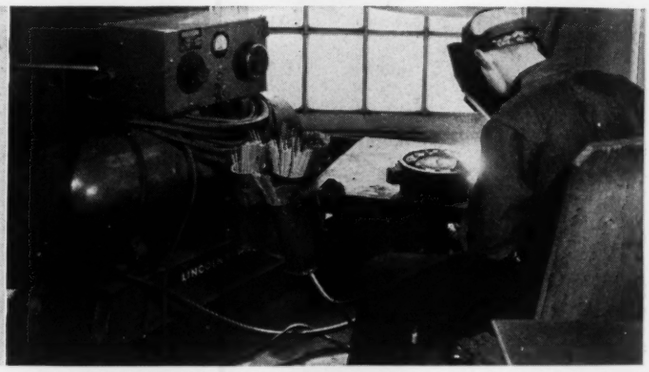
1. Exhaustive tests by aircraft manufacturers have proven the strength-superiority of the shielded arc process for welding critical parts such as landing gears and engine mounts. Inspection of a shielded arc weld shows you how perfect it is. And with proper procedure, it is usually stronger than the parent metal! *Photo courtesy Lockheed Aircraft Corp., Burbank, Calif.*



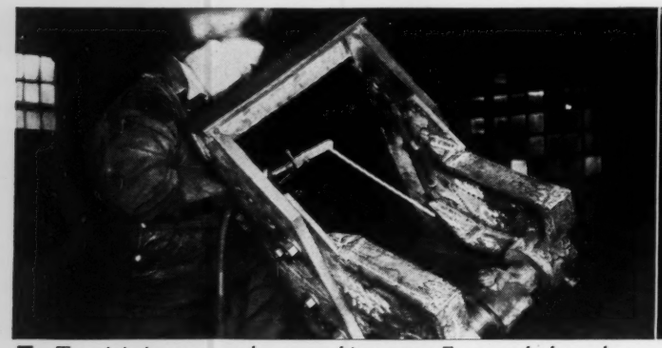
2. Welded steel design cuts costs by reducing the weight of material and by simplifying manufacture. Usually, the larger the part the greater the savings, although many small parts such as the swinging bracket illustrated above can be weld-economized. Try it!
Courtesy Rogers Bros. Corp., Albion, Pa.



3. Products are more saleable when they are streamlined by welded design. Example: The welded steel conveyor washer illustrated above. In this case, welding also has made production more flexible for special designs and has made possible a construction that is permanently leakproof.
Photo courtesy International Conveyor & Washer Corp., Detroit, Mich.



4. Welding simplifies the development of new and improved products. Here is a new type of electric cooking unit—operating by induction rather than resistance. Its construction is made possible by welding. The New *"Shield-Arc"* simplifies welding of its high silicon steel.
Photo courtesy The Griswold Manufacturing Co., Erie, Pa.



5. To minimize costs on heavy machine parts: Form steel plate—hot if necessary—on brakes. Machine before welding. Use heavy fixture and positioning jig, so as to allow high-speed welding with large electrodes in down-hand position. *Photo courtesy Wellman Engineering Co., Cleveland, Ohio*

6. By cutting costs and improving products by means of welding, many engineers and production supervisors have gained recognition in the eyes of the management resulting in advancement and increased earning power. It pays *you* to push changeover to welded design!

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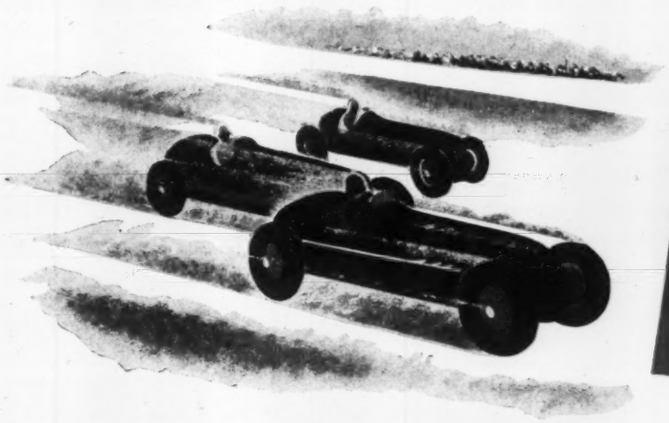

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